

# CONSERVING ALABAMA'S WILDLIFE

## A COMPREHENSIVE STRATEGY



ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES  
DIVISION OF WILDLIFE AND FRESHWATER FISHERIES

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2005

## National Advisory Acceptance Team Element Guide

The Alabama Department of Conservation and Natural Resources (ADCNR) Division of Wildlife and Freshwater Fisheries (DWFF) has prepared this guide to Alabama's Comprehensive Wildlife Conservation Strategy (CWCS) for the National Advisory Acceptance Team (NAAT) and others to readily find sections that address each of the eight required elements.

The CWCS has six chapters, the first four of which each focus on one of the eight elements (in sequential order: Elements 1-4 = Chapters 1-4). Chapters 5 and 6 each address two elements, 5 and 6 and 7 and 8, respectively. Appendices are provided for chapters 1, 2, 5, and 6. Figures, tables and appendices are labeled throughout the document with the first number referring to the corresponding chapter and the second number as the corresponding figure, table or appendix. For example, Figure 3-2 is the second figure in Chapter 3 and Appendix 1-3 is the third appendix supporting Chapter 1.

Frequently cited in the text, and provided to NAAT with this CWCS as an important supplementary reference, is the four-volume publication *Alabama Wildlife* (Mirarchi 2004, Mirarchi et al. 2004a-c), which is the foundation for this CWCS. *Alabama Wildlife* is derived from Alabama's Second Nongame Wildlife Conference, convened in July 2002 as part of the CWCS process to identify those species of greatest conservation need (GCN) by assembling scientific experts and stakeholders to compile the best data on the full array of Alabama's wildlife. The complete list of GCN species is presented in Appendix 1-3.

The Alabama CWCS is available through the ADCNR website ([www.outdooralabama.com/research-mgmt/cwcs](http://www.outdooralabama.com/research-mgmt/cwcs)) as Adobe PDF files. Detailed information about each of the GCN species and key habitats is also available on the ADCNR website for the CWCS, which provided the public the opportunity to submit comments at the species or habitat level as well as to find specific information on the status, ranking and affiliations between individual GCN species and habitat.

The process followed to develop the CWCS proceeded through each of the eight required elements and incorporated the guidance provided by the IAFWA and NAAT. DWFF staff, six taxa committees (mammals, birds, amphibians and reptiles, fishes, mussels and aquatic snails, crayfishes) and other partners assessed the abundance and distribution of fauna in Alabama, identifying GCN species based on available scientific information (Element 1). The Red-cockaded Woodpecker, for example, was identified as a GCN species following an evaluation of its status, abundance and distribution in the state, and existing conservation efforts that have identified it as a species of highest conservation concern. The Red-cockaded Woodpecker in Alabama is federally endangered and globally and state ranked (by NatureServe) as G3 and S2. Furthermore, the IUCN classifies the Red-cockaded Woodpecker as Vulnerable, and the U.S. Fish and Wildlife Service ranks it as Tier 1a (Immediate Action Needed) on its proposed list of priority bird species occurring in the region. The Birds taxa committee of Alabama's Second Nongame Wildlife Conference ranked the Red-cockaded Woodpecker as Priority 1, Highest Conservation Concern, and that status was adopted in the CWCS. Following its proposal as a GCN species, the public was invited to provide comments (as with all GCN species and key habitats) through the ADCNR website (Element 8).

The Red-cockaded Woodpecker principally inhabits two community types identified in this CWCS: *Dry Longleaf Pine Forest* and *Wet Pine Savanna and Flatwoods*. To a much lesser extent it may occur in *Dry Hardwood Forest* (Element 2). The two pine-dominated and fire-maintained habitats are relatively rare in Alabama (Element 2). Alabama's Red-cockaded Woodpecker population is threatened by habitat loss and degradation (e.g., residential development, conversion to short-rotation silviculture, fire suppression, fragmentation), nest predation, and cavity competition with other species (Element 3). Needed conservation actions to address these threats were then determined, and found to include restoration of degraded habitat and maintenance of existing habitat through prescribed burning, acquisition of large tracts of remaining habitat, and encouraging private landowners to participate in Alabama's statewide Safe Harbor Plan for the Red-cockaded Woodpecker (Element 4). A priority monitoring need for this GCN species is to determine population status and trends on federal and private lands (Element 3). The anticipated products of fulfilling this monitoring need are data to fill information gaps to assess the status and/or condition of Red-cockaded Woodpeckers and expansion of this species in the DWFF's CWCS database (Element 5). These data will also contribute to regional and national conservation efforts in which Alabama is a partner, such as the USFWS Red-cockaded Woodpecker Recovery Plan, Breeding Bird Survey, and the North American Landbird Conservation Plan (Element 7).

The conservation and/or increase of populations of Red-cockaded Woodpecker through habitat protection, restoration and/or enhancement was identified as a priority conservation action (Element 4). By monitoring the implementation and degree of success of these conservation actions, DWFF and its partners will be able to quantify the performance measures for each: including the number of known family groups (clusters), the number of landowners enrolled in the Safe Harbor program, and the number of acres restored, enhanced, and/or protected by fee-simple or easements (Element 5).

The adaptive management approach will allow DWFF to not only quantify these performance measures, but also compare the results of the species monitoring to infer whether the conservation actions are increasing the number of Red-cockaded Woodpecker clusters and/or nest productivity each year. If the status and condition of Red-cockaded Woodpeckers shows no significant improvement, then the conservation actions can be modified to intensify habitat protection measures, or target key areas and cooperative projects with partners if funds limit the expansion of the conservation measures (Elements 1, 3, 5 and 7). In this way, a feedback loop between monitoring, conservation actions and management objectives will be maintained (Elements 1-5).

Detailed information on the selection of GCN species (not just the Red-cockaded Woodpecker), key habitats, conservation actions and more are summarized throughout the CWCS and its appendices. The following table provides a key to finding where each of the eight required elements is addressed in the Alabama CWCS.

NAAT Guidance	CWCS Section	Page	Table or Figure	Page
<b>Element 1</b>				
<b>Information on the distribution and abundance of species of wildlife, including low and declining populations as the state deems appropriate, that are indicative of the diversity and health of the state's wildlife:</b>				
<b>1A.</b> The Strategy indicates sources of information (e.g., literature, databases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.	Chapter 1	6-10	Figure 1-1	9
	Bibliography	250		
	Appendix 1-1	268		
	Appendix 6-2	321		
<b>1B.</b> The Strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.			Figure 1-1	9
			Table 1-1	10
	Chapter 1	10-23	Table 1-2	12
	Appendix 1-3	295	Table 1-3	14
	Appendix 1-4	304	Table 1-4	16
	Chapter 4	55-215	Table 1-5	16
			Table 1-6	18
			Table 1-7	20
			Table 1-8	21
<b>1C.</b> The Strategy identifies low and declining populations to the extent data are available.	Chapter 1	10-23		
	Appendix 1-3	295		
	Appendix 1-4	304		
<b>1D.</b> All major groups of wildlife have been considered or an explanation is provided as to why they were not (e.g., including reference to implemented marine fisheries management plans). The State may indicate whether these groups are to be included in a future Strategy revision.	Chapter 1	4-23		
	Appendix 1-3	295		
	Appendix 1-4	304		
<b>1E.</b> The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.	Chapter 1	6-9		
	Appendix 1-2	279		

NAAT Guidance	CWCS Section	Page	Table or Figure	Page
<b>Element 2</b>				
<b>Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in the 1<sup>st</sup> element:</b>				
2A. The Strategy provides a reasonable explanation for the level of detail provided; if insufficient, the Strategy identifies the types of future actions that will be taken to obtain the information.			Figure 2-1	26
	Chapter 2	24-41	Figure 2-2	33
	Chapter 4	55-215	Figure 2-3	34
	Appendix 2-1	314	Figure 2-4	35
			Table 2-1	37
			Table 2-2	41
2B. Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.	Chapter 2	24-41	Figure 2-1	26
	Chapter 4	55-215	Figure 2-3	34
	Chapter 4	221-228	Figure 2-4	35
			Table 2-1	37
			Table 2-2	41
<b>Element 3</b>				
<b>Descriptions of problems which may adversely affect species identified in Element 1 or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats:</b>				
3A. The Strategy indicates sources of information (e.g., literature, databases, agencies, or individuals) used to determine the problems or threats.	Chapter 3	42-48		
	Appendix 1-1	268		
	Bibliography	250		
3B. The threats/problems are described in sufficient detail to develop focused conservation actions (for example, "increased highway mortalities" or "acid mine drainage" rather than generic descriptions such as "development" or "poor water quality").	Chapter 3	46,47	Figure 3-4	47
	Chapter 4	56-214		
3C. The Strategy considers threats/problems, regardless of their origins (local, State, regional, national and international), where relevant to the State's species and habitats.	Chapter 3	42-48	Figure 3-4	47
	Chapter 4	56-214		

NAAT Guidance	CWCS Section	Page	Table or Figure	Page
3D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.	Chapter 4	57-215		
3E. The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and survey projects after the Strategy is approved.	Chapter 4	57-215		
<b>Element 4</b>				
<b>Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions:</b>				
4A. The Strategy identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.	Chapter 4	49,50		
4B. The Strategy describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.	Chapter 4	50-215		
4C. The Strategy links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions (outlined in Element 5).	Chapter 4	58-215		
4D. The Strategy describes conservation actions (where relevant to the State's species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.	Chapter 4	58-215		
4E. If available information is insufficient to describe needed conservation actions, the Strategy identifies research or survey needs for obtaining information to develop specific conservation actions.	Chapter 4	58-215		
4F. The Strategy identifies the relative priority of conservation actions.	Chapter 4	58-215		

NAAT Guidance	CWCS Section	Page	Table or Figure	Page
<b>Element 5</b>				
Descriptions of the proposed plans for monitoring species identified in the 1 <sup>st</sup> element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4 <sup>th</sup> element, and for adapting these conservation actions to respond appropriately to new information or changing conditions:				
5A. The Strategy describes plans for monitoring species identified in Element 1, and their habitats.	Chapter 5	231-240		
5B. The Strategy describes how the outcomes of the conservation actions will be monitored.	Chapter 5	231-240	Table 5-1	237-238
5C. If monitoring is not identified for a species or species group, the Strategy explains why it is not appropriate, necessary or possible.	Chapter 5	231-240		
5D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.	Chapter 5	231-240		
5E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.	Chapter 5 Appendix 5-1	231 315		
5F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.	Chapter 5	232		
5G. The Strategy is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.	Chapter 5	233		
<b>Element 6</b>				
Descriptions of procedures to review the Strategy at intervals not to exceed 10 years:				
6A. The State describes the process that will be used to review the Strategy within the next 10 years.	Chapter 5	238-240		

NAAT Guidance	CWCS Section	Page	Table or Figure	Page
<b>Element 7</b>				
Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats:				
7A. The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, and Indian Tribes in the development of its Strategy.	Chapter 6 Appendix 6-2	243-247 321	Figure 6-1 Table 6-1	242 242
7B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy.	Chapter 6 Appendix 6-2	245-246 321		

<b>Element 8</b>				
Descriptions of the necessary public participation in the development, revision, and implementation of the Plan:				
8A. The State describes the extent of its efforts to involve the public in the development of its Strategy.	Chapter 6 Appendix 6-2	246-249 321		
8B. The State describes its continued public involvement in the implementation and revision of its Strategy.	Chapter 6 Appendix 6-2	249 321		

*Acknowledgments:* ADCNR- DWFF staff and contractor thank the IAFWA and the many state fish and wildlife agencies and staff that shared information throughout this process, and the many partners and supporters for their interest and contribution to this historical and intensive effort. We greatly appreciate the support and recommendations of reviewers within the DWFF, USFWS, Teaming With Wildlife, the National Advisory Acceptance Team, and ultimately the citizens of Alabama and Congress for which this effort was commissioned.



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## A COMPREHENSIVE STRATEGY

ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES  
DIVISION OF WILDLIFE AND FRESHWATER FISHERIES

*The mission of the Wildlife and Freshwater Fisheries Division is to manage, protect, conserve, and enhance the wildlife and aquatic resources of Alabama for the sustainable benefit of the people of Alabama.*

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2005



Bear Den Hollow, Jackson County

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## Executive Summary

This is an historic opportunity enabling the Alabama Department of Conservation and Natural Resources (ADCNR) to assess and address its outstanding wildlife diversity on a comprehensive statewide scale. Alabama surpasses all eastern states in plant and animal diversity, ranking fifth in the nation after California, Texas, Arizona, and New Mexico (Alabama Natural Heritage Program 2003). Alabama ranks first in the nation in freshwater species diversity, including more than 750 species of freshwater fishes, mussels, aquatic snails, and crayfishes. Unfortunately, no state east of the Colorado River has more wildlife species at risk than Alabama. Only Hawaii, California, and Nevada have more imperiled species, and only Hawaii has lost more species to extinction (Stein 2002). Mankind's alteration of Alabama's natural landscape and waterways has contributed to the extinction or extirpation of more than 100 animal species.

This document describes a strategy for the comprehensive conservation of Alabama's wildlife by addressing specific components required by the State Wildlife Grants (SWG) federal program that provides funding and administration through the U.S. Fish and Wildlife Service (USFWS), Office of Federal Assistance. Regional and nation level coordination was maintained throughout this effort, as well as with the International Association of Fish and Wildlife Agencies (IAFWA) Steering Committees and the Southeastern Association of Fish and Wildlife Agencies SWG Ad-Hoc Committee.

During this more than two year effort, the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries (DWFF) compiled, coordinated and integrated the best available scientific information on the status of Alabama's wildlife and the concerns, recommendations and existing conservation priorities of a diverse array of public and private stakeholders. It built upon the solid framework of the 2002 Nongame Symposium which assembled scientific experts and stakeholders to compile the best data on the full array of Alabama's wildlife and from that identify those species of greatest conservation need. This conservation strategy updates and expands the symposium proceedings, *Alabama Wildlife*, by engaging public and private stakeholders, including local, regional, state and federal agencies, organizations and tribes to identify priority conservation targets and actions for the next decade.

The Comprehensive Wildlife Conservation Strategy (CWCS) planning process began with an exhaustive inventory of existing natural resource information, programs and stakeholders. DWFF staff and contractors facilitated stakeholder participation in the development of the CWCS process as well as identification of wildlife species and habitats, threats and conservation actions. Leading experts and conservation partners from the private and public sectors helped develop, refine and prioritize conservation actions. The planning process resulted in significant coordination of conservation priorities from this diversity of programs and engaged a broad network of individuals and partners to improve communication, coordination and integration. It fostered the "system" approach that addressed wildlife species in the context of broader habitat

associations and more holistic assemblages representing biotic communities for more effective conservation.

Altogether, 314 aquatic and terrestrial wildlife species were identified as in greatest conservation need (GCN). These GCN fauna include 24 mammals, 26 reptiles, 14 amphibians, 28 birds, 57 fish, 93 mussels, 34 aquatic snails, and 28 crayfishes. A lack of information regarding the status of several invertebrate groups precluded their inclusion in this CWCS, and they will be targeted for further research with the intent of incorporating them into future revisions of the Strategy.

GCN species were associated with 15 key habitats and 15 river basins, including several types of forest, wetlands, and other unique communities such as caves and coastal beaches. The location, distribution and condition of each of these habitats was researched and summarized along with the GCN species it supports. Problems or threats facing the habitat and/or its species; priority research, survey and monitoring needs; an itemized list of priority conservation actions and key partnerships opportunities for implementation; high priority areas of the state for conservation; anticipated products and/or performance measures for each research and conservation action item; and a list of sources for more information were developed for each key habitat.

Alabama's land and waterscapes are threatened by habitat loss and fragmentation, loss of natural community integrity, impacts from disturbance and exotic species, and lack of adequate protection or information. The current distribution and status, as well as various aspects of life history and biology are poorly known for most GCN species in most habitats. Insufficient conservation-related education and outreach about biologically significant areas and species also threatens many habitats and species.

To address these threats, a series of conservation actions were developed for GCN species and key habitats. In some cases, educational outreach is needed to improve the public's level of understanding and need for stewardship of Alabama's fish and wildlife resources and their habitats. In other instances, specific research or landowner and partner outreach and coordination are needed to protect threatened habitats and/or GCN species. Controlling exotic species, restoring the use of fire to certain communities and reintroducing certain extirpated or rare aquatic species were also identified as high priority conservation actions. Supporting the full implementation of numerous partners' plans, including river basin management plans, federally listed species' recovery plans, Partners in Flight bird conservation plans, and the USFS Revised Management Plans were found to be important conservation actions as well.

Overarching statewide conservation actions were also developed, as many actions recurred for many species and habitats, and in existing conservation plans. Alabama's conservation actions therefore addressed needs at multiple scales and levels. The implementation of conservation actions will be coordinated with key partners wherever possible, including the U.S. Fish and Wildlife Service, U.S. Forest Service, Natural Resources Conservation Service, U.S. Army Corps of Engineers, Tennessee Valley Authority, Alabama Forestry Commission, Tennessee Aquarium Research Institute, The

Nature Conservancy, Partners in Flight, watershed groups, Forever Wild, land trusts, and many others.

Local, state and federal agencies and tribal partners were asked not only for input, but also to review the draft CWCS and their comments were incorporated into the final document. An effective measure of coordination success will be the degree to which each of these partners integrates GCN species, habitats and conservation actions into their plans and programs. One example of how this occurred early on in the CWCS process is that of the U.S. Forest Service incorporating the GCN species and habitats into their Revised Land and Resource Management Plan.

The implementation of CWCS priority conservation actions will be monitored via a DWFF tracking system that is based upon collaboration between the DWFF and SLD-NHP and GIS databases that track Alabama's fish and wildlife resources. As conservation actions are implemented, their effectiveness will be reviewed biennially by DWFF, and the status of species and habitats reassessed by the expert Taxa Committees and Technical Team. As needed, the conservation actions will be modified or new actions identified based on the effectiveness of the original actions in aiding the state's GCN species and habitats as intended. The CWCS will be updated every 10 years to reflect this adaptive management approach, allowing the Strategy to remain current to Alabama's needs to comprehensively conserve its fish and wildlife resources and their habitats.

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## Introduction

### ***Project Need***

This is an historic opportunity and challenge for the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries (DWFF), and its partners. The State Wildlife Grant (SWG) program, a new significant funding source, provides DWFF the first chance to comprehensively conserve wildlife. This is an opportunity to develop a Comprehensive Wildlife Conservation Strategy (CWCS) that identifies those wildlife species of greatest conservation need (GCN) and actions needed to conserve Alabama's wildlife and their key habitats. This is the time to design how DWFF and its partners in conservation can together proactively keep common species common and reverse the decline of rare species to prevent them from becoming endangered.

Within the last century, DWFF has restored the decimated populations of white-tailed deer, turkey, and other game species. These restoration efforts were made possible by dedicated, long-term funding derived from user fees, hunting, and fishing licenses. Unfortunately, little funding has historically been available for non-game species conservation and many species are now in serious decline. Restoration of such species has the greatest chance of success and is most cost effective if addressed before species decline to the point of needing Endangered Species Act protection. This CWCS defines those wildlife species in greatest need of conservation in Alabama and describes the actions necessary for their restoration. It is through this tool that we have the opportunity to work with conservation partners and the greater public to best utilize available resources to ensure that declining species are restored and common species remain common.

DWFF is leading the effort to collect the best available information and research findings from the many existing plans, programs and priorities. It is coordinating with local, state and federal agencies and non-governmental organization (NGO) conservation partners for input and collaboration to identify species of greatest conservation need and priority conservation actions. DWFF is anxious to work with conservation partners and constituents to develop the best approaches to ensure long-term conservation and enhancement of Alabama's unique wildlife heritage.

### ***Purpose***

Alabama's CWCS represents the results of a broad and inclusive approach to compile and present the best available information on the status of wildlife conservation in the state while involving the diversity of Alabama's public and private stakeholders. The purpose of this document is to provide direction for and coordination of wildlife conservation efforts in Alabama for the next decade. The overall goal is to identify and conserve those species in greatest need for conservation action while also addressing the full array of wildlife and habitats. Specific components are presented as required to meet legal obligations under the

SWG program, which provides funding and guidance for this effort through the U.S. Fish and Wildlife Service (USFWS), Office of Federal Assistance.

The conservation actions identified in this CWCS will be an essential foundation for the future of wildlife conservation, as well as a stimulus to engage federal, state, local public and private conservation partners to strategically coordinate their individual roles in prioritizing state wildlife conservation efforts. The development of the CWCS at the state level is the critical first step in defining the capabilities and needs of DWFF and its partners to accomplish wildlife conservation goals. This CWCS also identifies the measures that will be used to evaluate the results achieved and the threats and needs that remain for effective wildlife conservation in Alabama. The CWCS process provides an opportunity for DWFF to provide effective and visionary leadership in wildlife conservation. Strategy implementation with the new funds, periodic review, and resulting adaptive management makes this document a long-term tool for wildlife conservation.

## ***Background and Approach***

The Teaming With Wildlife (TWW) coalition, comprised of State fish and wildlife agencies and their governmental and non-governmental partners, has for over a decade, encouraged support for new sources of Federal funding to complement and expand State wildlife conservation programs. This support came in the form of annual appropriations to the states under the Wildlife Conservation and Restoration Program (WCRP) in Fiscal Year 2001 and the State Wildlife Grant program beginning in Fiscal Year 2002. Under these new programs, Congress provided an historic opportunity for the state fish and wildlife agencies and their partners to design and implement a more comprehensive approach to the conservation of America's wildlife. A requirement of WCRP and SWG is that each State, Territory, and the District of Columbia complete a CWCS by October 1, 2005.

Congress identified eight required elements (see Alabama CWCS Element Guide, appended to the beginning of this document) in the SWG legislation. During the development process, the International Association of Fish and Wildlife Agencies' (IAFWA) TWW Committee provided more specific Guiding Principles, including criteria to help states define the scope and focus of their strategies. The U.S. Fish and Wildlife Service's National Advisory Acceptance Team (NAAT) also provided guidance on basic information needed to satisfy the CWCS review and evaluation process. This document is designed in format and content to address these specific requirements.

In Alabama, this CWCS effort began under WCRP with DWFF sponsoring the 2002 Nongame Conference that assembled scientists/stakeholders to compile the best available information on Alabama's wildlife. This two-year effort resulted in the comprehensive four-volume publication *Alabama Wildlife* (Mirarchi 2004, Mirarchi et al. 2004a-c) and is the foundation for this CWCS. It developed ranking criteria, identified those species of greatest conservation need and recommended conservation actions for these GCN species.

Another noteworthy effort funded by WCRP is intended to provide a comprehensive publication on freshwater mussels of Alabama. Dr. James Williams, Dr. Arthur Bogan and

## Introduction

Mr. Jeff Garner are currently preparing a publication entitled "The Freshwater Mussels of Alabama and the Mobile Basin of Georgia, Mississippi and Tennessee". This publication will be of interest to state and federal fisheries and wildlife agencies, environmental management agencies, aquatic biologists and malacologists in Alabama and other states since it will cover approximately 60% of the U.S. fauna. Most of the book will be devoted to species accounts. Included will be descriptions of shell, soft anatomy and glochidia, as well as sections on similar species, general distribution, Alabama distribution, ecology and biology, and current conservation status. Each species will have a distribution map which will reflect recent survey efforts and historical collections from 16 museums. Introductory material will include topics such as commercial utilization and management, habitat, ecology and biology, and conservation as well as discussion on the history of malacology in Alabama and physiography of the state. Estimated completion of the manuscript is 2005, with publication anticipated in 2006. New information generated by this effort has been incorporated into this CWCS.

In 2004, DWFF contracted Terwilliger Consulting to assist in expanding the scope of *Alabama Wildlife*. The ensuing 18-month process to update, refine, and reformat this information involved significant coordination with many conservation partners and reorganization of several key components of the information contained in *Alabama Wildlife* to meet NAAT requirements for the CWCS and provide for regional/national consistency. For example, terrestrial and estuarine habitats were reformatted to meet consistency recommendations. Although terrestrial species were assigned to habitat types, most aquatic species were instead treated by river drainage. Also, species coverage was expanded to include crayfishes, of which Alabama has more species than any other state.

## Chapter 1. Alabama's Wildlife

Alabama owes its biological wealth to an abundance of water, complex geological terrain, and a moderate climate. Additionally, the state is uniquely situated so that the distribution limits of many “peripheral” species extend across its borders from the north, south, east, and west. As a result, Alabama surpasses all eastern states in plant and animal diversity, ranking fifth in the nation after California, Texas, Arizona, and New Mexico (Alabama Natural Heritage Program 2003). Alabama ranks first in the nation in freshwater species diversity. Unfortunately, no state east of the Colorado River has more wildlife species at risk than Alabama. Only Hawaii, California, and Nevada have more imperiled species, and only Hawaii has lost more species to extinction (Stein 2002). Mankind's alteration of Alabama's natural landscape and waterways has contributed to the extinction or extirpation of at least 108 animal species: 47 mussels, 44 aquatic snails, 11 fishes, five birds, and four mammals. This chapter describes the distribution and abundance of Alabama's fish and wildlife species (Element 1). Detailed information on the resources consulted in the preparation of this CWCS is contained in Appendix 1-1. Appendix 1-2 lists the changes that this CWCS has made from *Alabama Wildlife*, the primary data source. The complete list of GCN species can be found in Appendix 1-3, and Appendix 1-4 describes other imperiled invertebrates not covered by this CWCS.

Virtually all of Alabama's wildlife habitats have experienced some form of degradation, and “natural” areas, for the most part, exist as fragments of varying size in a matrix of agriculture, short-rotation silviculture, residential and industrial development, reservoirs, utility corridors, and roads. As a result, fire, which is essential for the maintenance of a number of terrestrial habitats, can no longer occur naturally at the landscape scale. In age, structure, and species composition, today's forests are very different from those inhabited by Native Americans and described by early European settlers. A century ago the American chestnut blight wiped out the dominant tree of northern Alabama's deciduous forests, and the once-vast longleaf pine (*Pinus palustris*) forests of southern Alabama are now reduced to a fraction of their former extent. Terrestrial and aquatic habitats have been invaded by alien plant and animal species that compete with natives. Alabama has lost more than 50 percent of its wetlands (Phillips 2002), and many rivers and streams have been impounded, channelized, and polluted.

Alabama, along with adjacent portions of the southeastern United States, is a well-known global hotspot for aquatic biodiversity. Among the most species-rich groups of this fauna are turtles (Lydeard and Mayden 1995), fishes (Warren et al. 2000), mollusks (Williams et al. 1993, Neves et al. 1997), crustaceans (Taylor et al. 1996), and insects (Morse et al. 1997, Harris et al. 1991). This diverse fauna is threatened by widespread environmental changes, and the number of species in jeopardy continues to rise (Master et al. 1998; Abell et al. 2000; Pringle et al. 2000; Warren et al. 2000). Alabama has lost over 100 aquatic freshwater species, and scientists and natural resource managers need more complete information about the status and biology of the fauna to make informed decisions to prevent further losses.

The best available checklists and databases addressing status of the full array of wildlife in Alabama are those of the Alabama Department of Conservation and Natural Resources' (ADCNR) State Lands Division's Natural Heritage Section and NatureServe (Alabama Natural Heritage Program 2004). Additionally, an important component of this CWCS process is ADCNR's Division of Wildlife and Freshwater Fisheries' development of a comprehensive database to capture and track information on GCN species and their key habitats. For a more detailed list on sources of information and existing plans addressing Alabama's wildlife, see Appendix 1-1.

### ***Value and Importance of Wildlife***

Wildlife and wildlife habitats are part of the culture of Alabama. Whether fishing, hunting, watching wildlife or feeding backyard birds, Alabamians derive many hours of enjoyment from wildlife-related recreation. Wildlife recreation is the cornerstone of our conservation ethic. Alabama's wildlife and natural habitats contribute on many levels to the quality of life experienced by residents and visitors alike. More than half a century ago, Aldo Leopold recognized the value of wildlife to society: "Some have attempted to justify wildlife conservation in terms of meat, others in terms of personal pleasure, others in terms of cash, still others in the interest of science, education, agriculture, art, public health, and even military preparedness. But few have so far clearly realized and expressed the whole truth; namely that all these things are but factors in a broad social value, and that wildlife is a social asset" (Leopold 1953).

Efforts to estimate the true value of wildlife and wild places to people have met with limited success. How does one determine the worth of the spiritual renewal and relief from stress that is experienced by a walk in the woods, fishing a wild stream, or listening to bird songs on a spring morning? It is likewise impossible to put a precise dollar value on forests that replenish oxygen and cleanse the air, wetlands that clear toxic elements from the water and absorb runoff, or wildlife species that control agricultural pests, disperse seed, recycle nutrients, or pollinate plants. In many ways the role they play in our lives would have to be considered priceless.

Some economic values of wildlife can be quantified. Wildlife-related recreation annually contributes over \$2 billion to Alabama's economy. The tenth National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Fish and Wildlife Service and U.S. Census Bureau 2003) found that 1.6 million Alabamians and visitors 16 years old and older took advantage of Alabama's wildlife abundance and diversity in 2001. Of this number, 851 thousand fished, 423 thousand hunted, and 1.0 million participated in wildlife-watching activities, including observing, feeding, and photographing wildlife. Wildlife related expenditures (\$2.3 billion in 2001) included trip-related expenses, equipment purchases, licenses, land leases, membership dues, etc.

Commercial and recreational marine and estuarine fisheries also contribute to the state's economy, with an average of \$44.8 million in commercial landings of 26.2 pounds of finfish and shellfish from 1993 to 2003 (*pers. comm.*, NMFS, Fisheries Statistics Division, Silver Spring, MD, May 25, 2005). The bulk of the commercial landings are from shrimp (an

average of \$35.7 million annually); blue crab and oysters are the second and third most valuable fisheries, while striped mullet, snappers, and Atlantic croaker are the three most valuable commercial fish species. An average of 7.6 million estimated pounds of fish are recreationally harvested through Alabama annually, with snappers, drums, tunas and mackerels the highest catches by weight between 1981 to 2004 (*Pers. Comm.*, NMFS, Fisheries Statistics and Economics Division, May 27, 2005).

Some species have a disproportionate influence on other species in a community; such animals are called “keystone species.” The loss of a keystone species can lead to loss of other species and result in a fundamental change in a community (Reid and Miller 1989). An example of a keystone species is the gopher tortoise. The tortoise creates deep burrows in sandy soils, creating important refugia exploited by other reptiles, amphibians, mammals, and even birds. Many invertebrates have evolved to depend wholly on the tortoise burrow, so the loss of the gopher tortoise could result in the loss of dozens of other species.

The loss of one species can have profound, unanticipated, and far-reaching wildlife and economic impacts. We are just beginning to understand these complex communities in Alabama. Further research is needed to identify keystone species in Alabama habitats before they are lost, and more complete biological inventories are needed to better understand the complex relationships within existing communities.

### ***Identifying Species of Greatest Conservation Need***

Identification of species of greatest conservation need (Element 1) and their habitats (Element 2) began in July 2002 by involving key partners and stakeholders (Element 7) with Alabama's Second Nongame Wildlife Conference. That meeting, funded by WCRP, was attended by 240 individuals representing a cross section of scientific expertise and land-use stakeholders. Five taxa committees led the discussion and evaluation of Alabama's more than 1,100 native species of mussels and aquatic snails, fishes, amphibians and reptiles, birds, and mammals. Every native species was assigned a status based on the expert opinion of the taxa committees, based on the following criteria:

- **Extinct** - taxa that historically occurred in Alabama, but are no longer alive anywhere within their former distribution.
- **Extirpated** - taxa that historically occurred in Alabama, but are now absent; may be rediscovered in the state, or be reintroduced from populations existing outside the state.
- **Extirpated/Conservation Action Underway** - taxa that historically occurred in Alabama, were absent for a period of time, and currently are being reintroduced, or have a plan for being reintroduced, into the state from populations outside the state.
- **Priority 1/Highest Conservation Concern** - taxa critically imperiled and at risk of extinction/extirpation because of extreme rarity, restricted distribution, decreasing population trend/population viability problems, and specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Immediate research and/or conservation action required.

## Chapter 1: Alabama's Wildlife

- **Priority 2/High Conservation Concern** - taxa imperiled because of three of four of the following: rarity; very limited, disjunct, or peripheral distribution; decreasing population trend/population viability problems; specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Timely research and/or conservation action needed.
- **Priority 3/Moderate Conservation Concern** - taxa with conservation problems because of insufficient data **or** because of two of four of the following: small populations; limited, disjunct, or peripheral distribution; decreasing population trend/population viability problems; specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Research and/or conservation action recommended.
- **Priority 4/Low Conservation Concern** - taxa that are secure, yet conservation concerns exist because of one of four of the following: relative abundance; limited, disjunct, or peripheral distribution; decreasing population trend/population viability problems; specialized habitat needs/increasing habitat vulnerability due to natural/human-caused factors. Research on specific problem suggested.
- **Priority 5/Lowest Conservation Concern** - taxa that are demonstrably secure, with size of population stable/increasing, geographical distribution stable/expanding, population trend/population viability stable/increasing, relatively limited habitat vulnerability due to natural/human caused factors, **or** an unusual visitor to the state. No specific monitoring or conservation action needed.

This evaluation resulted in the designation of 250 species as either Extirpated, Extirpated/Conservation Action Underway, Priority 1/Highest Conservation Concern or Priority 2/High Conservation Concern and these species were subsequently designated GCN in the CWCS development process. Species accounts including the status and distribution, threats and conservation actions of GCN vertebrate and aquatic mollusk species are provided in *Alabama Wildlife*. Some changes in GCN coverage occurred based on new information for particular species developed since the Nongame Wildlife Conference (Appendix 1-2a), resulting in 314 species treated as GCN in the CWCS. The complete list of Alabama's GCN species is included as Appendix 1-3.

Species coverage was then expanded to include crayfishes based on a review of available information (Schuster and Taylor 2004) and a workshop in February 2005, attended by more than 40 aquatic biologists. Through this process, conservation priority ranks were assigned to each species, using the same criteria described above, for taxonomic groups included in *Alabama Wildlife*. A summary of distribution, habitat, and status of Alabama's crayfishes is provided in this document as Appendix 1-2b.

The Nongame Wildlife Conference provided the beginning and foundation for local, state and federal agencies and organizations and tribal involvement in the CWCS process. Participation was solicited at academic and government institutions and invitations were extended to all key local, state and federal entities with programs that significantly affected wildlife conservation in Alabama. Involvement of the taxa committees continued through publication of *Alabama Wildlife* in June 2004, the four-volume reference resulting from the Conference. Partners on the taxa committees included most of the key state and federal



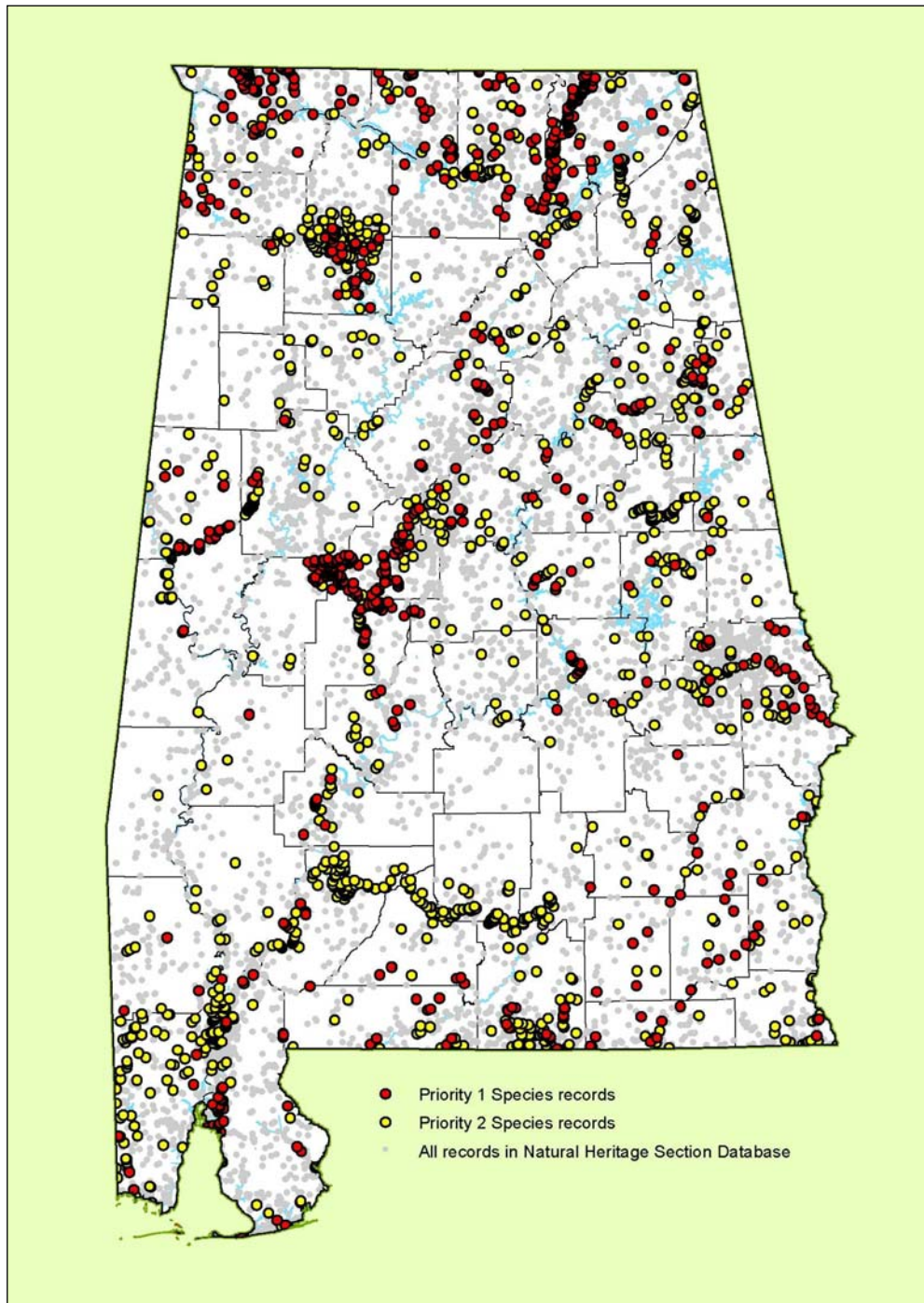
agencies in Alabama, including USFWS National Wildlife Refuge (NWR) and Ecological Services, Natural Resources Conservation Service (NRCS), U.S. Forest Service (USFS), U.S. Army Corps of Engineers (USACOE), Mobile Bay National Estuary Program (NEP), DWFF, ADCNR State Lands Division Natural Heritage Section (SLD-NHS), Alabama Department of Environmental Management (ADEM), NatureServe-Alabama Natural Heritage Program (NS-ALNHP), Tennessee Valley Authority (TVA), Alabama Department of Economic and Community Affairs (ADECA), etc. Therefore, the major stakeholders and partners developed the list of species and conservation recommendations, as DWFF played an oversight role throughout 2002-2004. This group of partner stakeholders not only ranked all species, but developed conservation actions and species accounts for each of the 250 high priority species. Thus, partner and expert participation has been critical to the process since it began in 2002.

In developing this CWCS, the five taxa committees were reengaged to serve the role of External/Expert Peer Review. Each taxa committee was asked to review and update the lists of GCN species and habitats as well as conservation actions. Their technical input and on-going review and feedback was organized through five separate taxonomic sub-committees (mammals, birds, herpetofauna, fish, mussels and aquatic snails) throughout 2004. This group of almost 30 members represented a wide variety of academic institutions and conservation organizations, and provided essential peer review for technical quality control.

Since *Alabama Wildlife* went to press, one new fish species has been added to Alabama's fauna. The Blackmouth Shiner, a species previously known from Florida and Mississippi, was discovered in 2003. Since no species account is available in *Alabama Wildlife*, one is provided as Appendix 1-2c.

This CWCS expands species coverage from *Alabama Wildlife* to include crayfishes. However, neither *Alabama Wildlife* nor this CWCS addresses terrestrial snails, spiders, harvestmen, pseudoscorpions, millipedes, beetles, springtails, mayflies, butterflies, skippers, moths, and other invertebrates. Many of these belong to poorly studied taxonomic groups and have not historically received sufficient attention. Because of this paucity of data it is premature to consider them as GCN without additional information and stakeholder input. Therefore, they will be addressed systematically by taxa groups with expert input as funding and expertise become available. An example of how this will be accomplished is the recent comprehensive review of crayfish, resulting in the addition of many species to the GCN list. Experts were located and a project funded in 2004-05 to determine the status of this important invertebrate group.

Table 1-1 summarizes the state, federal, and global listings and abundance ranks for Alabama's species by taxonomic group. Those ranked by *Alabama Wildlife* as Extirpated, Extirpated/Conservation Action Underway, Priority 1/Highest Conservation Concern and Priority 2/High Conservation Concern served as a starting point for development of the CWCS list of GCN species. The number of Priority 3/Moderate Conservation Concern, "watch list" species, is also provided for each group, but these are not treated as GCN species in this document.



**Figure 2-1. Mapped occurrences of P1 and P2 taxa, from SLD-Natural Heritage Section**

**TABLE 1-1. ALABAMA'S NATIVE ANIMAL WILDLIFE DIVERSITY**

TAXA	TOTAL SPECIES	EXTINCT	EXTIRPATED	P1 <sup>1</sup>	P2 <sup>2</sup>	P3 <sup>3</sup>	FEDERALLY LISTED <sup>4</sup>	G1-G2 RANKED <sup>5</sup>	S1-S2 RANKED <sup>6</sup>
<i>GCN SPECIES</i>									
MAMMALS	64	0	4	7	13	11	5	2	13
BIRDS	247 <sup>7</sup>	3	2	7	19	53	6	0	36
REPTILES	93	0	0	9	17	18	9	7	24
AMPHIBIANS	73	0	0	6	8	11	3	5	14
FISHES	308	2	9	21	27	33	14	34	91
MUSSELS	175	22	24	51	17	24	43	71	90
AQUATIC SNAILS	174	39	4	17	13	71	10	66	56
CRAYFISHES	83	0	0	3	25	28	0	12	19
TOTAL	1,217	66	43	121	139	249	90	197	343

Each taxonomic group is discussed further in the following sections. Refer to Appendix 1-3 for scientific names of GCN species. For the most complete list and accounting of rare wildlife species and natural community status, see the Alabama Inventory List, maintained by NS-ALNHP ([www.alnhp.org](http://www.alnhp.org)). This represents the best available summary of information on abundance, distribution and status of rare wildlife species for Alabama.

<sup>1</sup> Highest Conservation Concern in Alabama

<sup>2</sup> High Conservation Concern in Alabama

<sup>3</sup> Moderate Conservation Concern in Alabama; considered the "watchlist"

<sup>4</sup> Listed as Threatened or Endangered by U.S. Dept. of the Interior

<sup>5</sup> Critically imperiled (G1) or imperiled (G2) across its entire range (NatureServe-Natural Heritage Rank)

<sup>6</sup> Critically imperiled (S1) or imperiled (S2) in Alabama (NatureServe-Natural Heritage Rank)

<sup>7</sup> This figure is for regularly-occurring birds and excludes accidentals, "vagrants," etc.

## Overview of Alabama's Major Wildlife Groups

This section is a summary of all of Alabama's major groups of vertebrate and invertebrate wildlife addressed in this CWCS (Element 1). High Priority conservation needs of individual species and key habitats are summarized in Chapter 4 (Element 4). Detailed accounts of status, abundance, distribution and threats can be found in the references cited below, with *Alabama Wildlife* generally providing the most current available scientific information.

### ***Mammals***



Florida black bear (*Ursus americanus floridanus*)

USFWS Photo

Sixty-four mammal species have occurred in Alabama in recent times, including 20 rodents, 15 bats, 14 carnivores, six insectivores, four rabbits, three ungulates, one opossum, and one armadillo (Table 1-2). Four of these (Red Wolf [USFWS 1990a], Florida Panther/Eastern Cougar [USFWS 1987a], Elk, and Bison) have been extirpated. In addition to the 60 native mammals still maintaining populations in the state, there are introduced breeding populations of six exotic species (Black Rat, Norway Rat, House Mouse, Nutria, Fallow Deer, and Feral Swine). According to the best scientific information and consensus of numerous experts, there are 24 GCN mammal taxa. The only published monograph devoted solely to Alabama's mammals is Howell (1921), although numerous research projects and graduate theses have been conducted on various mammals at Alabama academic institutions. The most current and best available scientific information on the status and distribution of Alabama's GCN mammals is provided in *Alabama Wildlife*.



The DWFF monitors the status of harvested mammal species, including deer, small game, and furbearers. The biology of White-tailed Deer and history of their management in Alabama has been summarized by the DWFF Wildlife Section (Cook and Gray 2003). The Furbearers Observation Survey and Fur Harvest Summary compile statewide data on road-killed and trapped mammals (Sievering 2004). The Alabama Black Bear Alliance is a joint effort of the Alabama Wildlife Federation, The Nature Conservancy, and DWFF, and works toward conservation of Black Bears in the state. DWFF Nongame Wildlife Program biologists frequently conduct bat and other small mammal surveys (Hudson 2004).

Similarly, marine mammals have been monitored through Alabama's DCNR coastal programs and Gulf-wide by NMFS and USFWS. The Bottle-nosed Dolphin and West Indian Manatee (USFWS 1995) are the only two regularly occurring marine mammals in Alabama waters. A Marine Mammal Stranding Network coordinated by Spring Hill College has monitored marine mammal strandings in the state (Fertl et al. 2005). Recovery plans for the threatened, endangered, and protected species, as well as stock assessments by NMFS address the other marine mammals protected under the Marine Mammal Protection Act as they occur only accidentally in Alabama waters.

**TABLE 1-2. MAMMALS OF ALABAMA**

CLASS MAMMALIA	64 (+ MARINE) NATIVE SPECIES, 25 GCN	No. GCN SPECIES	TOTAL NO. SPECIES <sup>8</sup>
ORDER ARTIODACTYLA	DEER, BISON, SWINE	2	5*
ORDER CARNIVORA	CARNIVORES	5	14
ORDER CETACEA	WHALES, DOLPHINS	0	2
ORDER CHIROPTERA	BATS	8	16
ORDER INSECTIVORA	SHREWS AND MOLES	1	6
ORDER DIDELPHIMORPHA	NEW WORLD OPOSSUMS	0	1
ORDER XENARTHRA	ARMADILLOS	0	1
ORDER LAGOMORPHA	RABBITS	2	4
ORDER RODENTIA	RODENTS	5	26*
ORDER SIRENIA	SIRENS	1	1

\* Includes one or more introduced species

<sup>8</sup> Excludes extinct species

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**Birds**

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Snowy Plover (*Charadrius alexandrinus*)

Bill Summerour

Alabama has 247 regularly wintering and/or breeding bird species. Three additional species, Passenger Pigeon, Carolina Parakeet, and Bachman's Warbler (USFWS 1990b) are extinct, and the Ivory-billed Woodpecker, Common Raven, and Mississippi Sandhill Crane (USFWS 1991a) no longer are known to occur within the state's borders. The Ivory-billed Woodpecker was presumed extinct by many authorities until its 2004 rediscovery in Arkansas (Fitzpatrick et al. 2005). The availability of potentially suitable habitat in Alabama raises the possibility that the species may still occur in the state. According to the best scientific information and consensus of the bird taxa committee comprised of Alabama's leading bird authorities, there are 28 GCN bird species (Table 1-3, Appendix 1-3).

Detailed accounts of bird diversity in Alabama are provided by Howell (1924) and Imhof (1962, 1976), and the status of each GCN species is provided in *Alabama Wildlife*. A five-year, statewide Breeding Bird Atlas being conducted by the Alabama Ornithological Society will be completed in 2006. When published, the results will provide information on breeding bird distribution in Alabama in far greater detail than has been previously available.

The decline in abundance and distribution of many migratory landbirds is well documented regionally (Rich et al. 2004). Alabama falls within four North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs): Central Hardwoods, Southeastern Coastal Plain, Appalachian Mountains, and Piedmont. Alabama also includes five Partners in Flight (PIF) physiographic provinces for which bird conservation plans are

being prepared: the Interior Low Plateau (Ford et al. 2000), and four which are in draft form: Northern Cumberland Plateau, Southern Ridge and Valley, Southern Piedmont, and East Gulf Coastal Plain. These plans identify 9, 13, 16, 14, and 29 bird species, respectively, as conservation priorities for each region.

Similar regional trends for waterbirds have been documented, initiating the creation of a number of plans and partnerships aimed at waterbird conservation. Alabama is included in a variety of these, including: North American Waterbird Conservation Plan (Kushlan, et al. 2000), U.S. Shorebird Conservation Plan (Brown et al. 2001), Waterbird Monitoring Partnership (coordinated by the USGS Patuxent Wildlife Research Center's Monitoring Program), and North American Waterfowl Management Plan (NAWMP Committee 1999) East Gulf Coastal Plain Joint Venture. These programs share the best available species abundance and distribution data nationally, and step conservation down to the regional and state levels.

**TABLE 1-3. BIRDS OF ALABAMA**

CLASS AVES	378 NATIVE SPECIES <sup>9</sup> , 28 GCN	No. GCN SPECIES	TOTAL NO. SPECIES <sup>10</sup>
ORDER GAVIIFORMES	LOONS	0	3
ORDER PODICIPEDIFORMES	GREBES	0	5
ORDER PROCELLARIIFORMES	ALBATROSSES, SHEARWATERS, PETRELS	0	7
ORDER PELECANIFORMES	PELICANS, FRIGATEBIRDS, AND ALLIES	0	10
ORDER CICONIIFORMES	HERONS, STORKS, IBISES, AND ALLIES	3	19
ORDER ANSERIFORMES	SWANS, GEESE, AND DUCKS	1	33
ORDER FALCONIFORMES	FALCONS, KITES, EAGLES, HAWKS	3	17
ORDER GALLIFORMES	GROUSE, TURKEY, AND QUAIL	0	3
ORDER GRUIFORMES	CRANES, RAILS, AND ALLIES	2	10
ORDER CHARADRIIFORMES	SHOREBIRDS, GULLS, AND ALLIES	5	63
ORDER COLUMBIFORMES	PIGEONS AND DOVES	0	5*
ORDER CUCULIFORMES	CUCKOOS AND ALLIES	0	3
ORDER STRIGIFORMES	OWLS	1	7
ORDER CAPRIMULGIFORMES	GOATSUCKERS	0	3
ORDER APODIFORMES	SWIFTS AND HUMMINGBIRDS	0	8
ORDER CORACIIFORMES	KINGFISHERS	0	1
ORDER PICIFORMES	WOODPECKERS	2	9
ORDER PASSERIFORMES	PASSERINE BIRDS	11	156*

\* Includes one or more introduced species

<sup>9</sup> Includes migrants, but not 51 "accidentals"

<sup>10</sup> Excludes extinct species

## ***Amphibians and Reptiles***



Pine Barrens Treefrog (*Hyla andersonii*)

John Jensen

Alabama's amphibians and reptiles, collectively called the herpetofauna, include 73 native amphibians (30 frogs, 43 salamanders) and 93 reptiles (12 lizards, 49 snakes, 31 turtles, and alligator). Five established exotic species, one frog and four lizards, also are documented. The Eastern Indigo Snake (USFWS 1982b), Southern Hognose Snake, Mimic Glass Lizard, Mississippi Gopher Frog, and Flatwoods Salamander have not been documented for many years, and may be extirpated. According to the best scientific information and consensus of numerous experts, there are 26 GCN reptile and 14 GCN amphibian taxa, or 25 percent of Alabama's extant species (Tables 1-4, 1-5, Appendix 1-3).

Mount (1975) provides the most comprehensive published treatment of the distribution, abundance, and natural history of Alabama's herpetofauna, and the updated status of each species is provided in *Alabama Wildlife*. The Alabama Herpetological Atlas Project, administered by the Auburn University Natural History Museum and Learning Center, maintains a current database on distribution of the state's herpetofauna ([www.ahap.org](http://www.ahap.org)).



Flattened Musk Turtle (*Sternotherus depressus*)

Mark Bailey

**TABLE 1-4. AMPHIBIANS OF ALABAMA**

CLASS AMPHIBIA	73 NATIVE SPECIES, 14 GCN	No. GCN SPECIES	TOTAL NO. SPECIES
ORDER ANURA	FROGS AND TOADS	6	31 *
ORDER CAUDATA	SALAMANDERS	8	43

\* Includes one or more introduced species

**TABLE 1-5. REPTILES OF ALABAMA**

CLASS REPTILIA	93 NATIVE SPECIES, 26 GCN	No. GCN SPECIES	TOTAL NO. SPECIES <sup>11</sup>
ORDER CROCODYLIA	ALLIGATOR	0	1
ORDER SQUAMATA			
SUBORDER LACERTILIA	LIZARDS	3	16 *
SUBORDER SQUAMATA	SNAKES	12	49
ORDER TESTUDINES	TURTLES	11	31

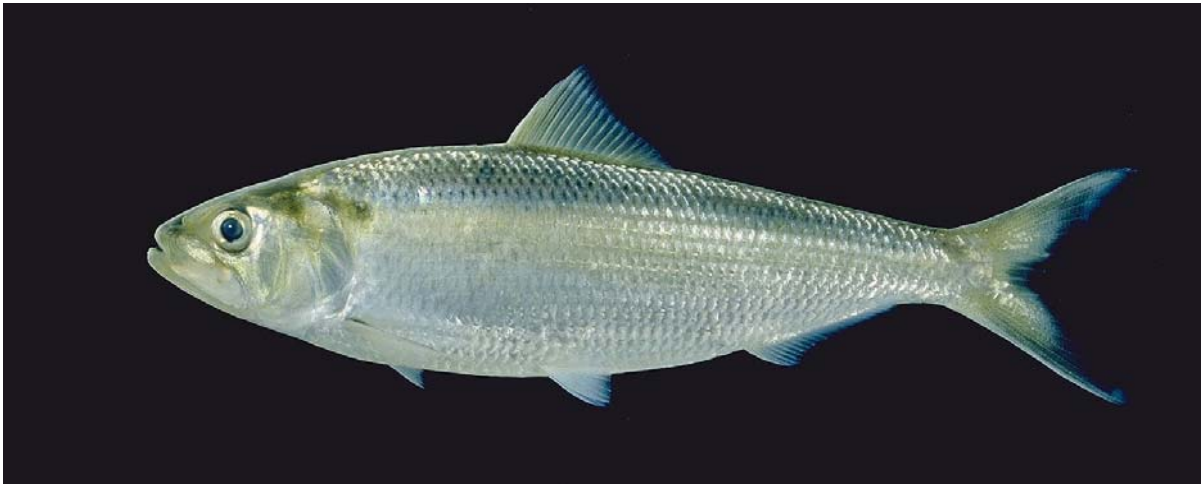
\* Includes one or more introduced species

<sup>11</sup>Includes several subspecies

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***Fishes***

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Alabama Shad (*Alosa alabamae*)

Patrick O'Neil

Holiday Darter (*Etheostoma brevirostrum*)

Malcolm Pierson

Three hundred and eight native freshwater fish species are known to have occurred in Alabama in recent times, including 13 undescribed taxa recognized as unique but not yet formally described in the scientific literature. Of this total, eleven species are either extinct or extirpated. In addition to the 297 native fish species still maintaining populations in the state, there are now breeding populations of ten exotic species. Approximately 250 species of saltwater fish have been documented from Alabama's marine waters (J. Mareska, pers. comm). According to the best scientific information and consensus of numerous experts, there are 57 GCN fish taxa (Table 1-6, Appendix 1-3).

The most current and detailed accounts of Alabama's fish diversity is provided by Boschung and Mayden (2004) and Mettee et al. (1996). Additional information for GCN species and the conservation status of all species is provided in *Alabama Wildlife*.

## Chapter 1: Alabama's Wildlife

**TABLE 1-6. FRESHWATER FISHES OF ALABAMA**

	306 NATIVE SPECIES, 57 GCN <sup>12</sup>	No. GCN SPECIES	TOTAL No. SPECIES
CLASS CHONDRICHTHYES	CARTILAGINOUS FISHES: 1 NATIVE SPECIES		
ORDER CARCHARHINIFORMES	SHARKS	0	1
CLASS CEPHALASPIDOMORPHI	LAMPREYS: 6 NATIVE SPECIES		
ORDER PETROMYZONTIFORMES	LAMPREYS	0	6
CLASS ACTINOPTERYGII	BONY FISHES: 299 NATIVE SPECIES		
ORDER ACIPENSERIFORMES	STURGEONS AND PADDLEFISHES	4	5
ORDER LEPISOSTEIFORMES	GARS	1	4
ORDER AMIIFORMES	BOWFIN	0	1
ORDER HIODONTIFORMES	MOONEYES	1	2
ORDER ANGUILLIFORMES	EELS	0	1
ORDER CLUPEIFORMES	ANCHOVIES AND HERRINGS	1	5
ORDER CYPRINIFORMES	CARPS, MINNOWS, AND SUCKERS	15	117*
ORDER SILURIFORMES	CATFISH	5	19
ORDER ESOCIFORMES	PIKES AND MUDMINNOWS	0	3*
ORDER SALMONIFORMES	SMELTS, TROUTS, AND SALMONS	0	2*
ORDER PERCOPSIFORMES	PIRATE PERCHES	0	1
ORDER AMBLYOPSIFORMES	CAVEFISHES	1	2
ORDER MUGILIFORMES	MULLETS	0	1
ORDER ATHERINIFORMES	SILVERSIDES	0	3
ORDER BELONIFORMES	NEEDLEFISHES AND ALLIES	0	1
ORDER CYPRINODONTIFORMES	TOPMINNOWS, LIVEBEARERS, AND ALLIES	0	22
ORDER SCORPAENIFORMES	SCULPINS AND ALLIES	1	4
ORDER PERCIFORMES	SUNFISHES, PERCHES, AND ALLIES	28	114*
ORDER PLEURONECTIFORMES	FLOUNDERS	0	2

\* Includes one or more introduced species

<sup>12</sup> Excludes 2 extinct species, but includes 9 extirpated species.

### ***Mussels and Aquatic Snails***



Little-wing Pearlymussel (*Pegias fabula*)

Art Bogan

One hundred seventy-seven freshwater mussel species and 174 freshwater snails have been reported from Alabama. Most have suffered from degradation of streams and rivers, and only 71 percent of the mussel species and 75 percent of the freshwater snail species can still be found in the state. Nationally and regionally, many freshwater mollusk species have become extinct and others are in danger of extinction (Williams et al. 1993).

According to the best scientific information and consensus of numerous experts, there are 93 GCN mussel and 34 GCN aquatic snail taxa, or 50 percent of Alabama's extant species (Table 1-7 and Appendix 1-3). Although many (>40) aquatic snails ranked as Priority 3 at the Nongame Conference are not included in this Strategy as GCN taxa, their ranks reflect very limited information in many cases. The need for additional information on these species is acknowledged. Accounts for GCN species and the conservation status of all species are provided in *Alabama Wildlife*.



Anthony's Riversnail (*Athearnia anthonyi*)

Art Bogan



**TABLE 1-7. FRESHWATER MOLLUSKS OF ALABAMA**

CLASS BIVALVIA	FRESHWATER MUSSELS: 151 NATIVE SPECIES, 93 GCN	No. GCN SPECIES	TOTAL No. SPECIES <sup>13</sup>
ORDER UNIONOIDA		93	151
CLASS GASTROPODA	FRESHWATER SNAILS: 132 NATIVE SPECIES, 34 GCN		
ORDER ARCHITAENIOGLOSSA		3	10
ORDER NEOTAENIOGLOSSA		31	102
ORDER HETEROSTROPHA		0	1
ORDER BASOMMATOPHORA		0	19

Cockle Elimia (*Elimia cochliaris*)

Malcolm Pierson

<sup>13</sup> Excludes extinct species

## Crayfishes

*Procambarus okaloosae*

Guenter Schuster

The biology and distribution of Alabama crayfishes is poorly documented (Bouchard 1976, Harris 1990). This problem is compounded by the fact that the state currently lacks resident expertise in the identification and biology of these species, which resulted in their exclusion from *Alabama Wildlife*. To address this deficiency, SWG funded a study to: 1) gather all known literature on the crayfishes of Alabama, 2) compile a species list for Alabama, and 3) summarize published information about known distribution records for each species. This study was undertaken by Dr. Guenter Schuster of Eastern Kentucky University and Dr. Christopher Taylor of the Illinois Natural History Survey. They identified 83 resident species and eight species of questionable occurrence, giving Alabama the largest fauna of any state, including more than 20 percent of all North American species (Schuster and Taylor 2004). A workshop in February 2005, attended by more than 40 aquatic biologists, assigned conservation priority ranks to each species, using the same criteria as the taxonomic groups included in *Alabama Wildlife* (Table 1-8, Appendix 1-3).

**TABLE 1-8. CRAYFISHES OF ALABAMA**

CLASS MALACOSTRACA	83 NATIVE SPECIES, 28 GCN	No. GCN SPECIES	TOTAL No. SPECIES
ORDER DECAPODA		28	83

### ***Other Invertebrates***



Mitchell's Satyr (*Neonympha mitchellii mitchellii*)

Barry Hart

Other invertebrate groups are also incredibly diverse in Alabama, including terrestrial snails, other crustaceans, dragonflies, butterflies, beetles and other insects, spiders, millipedes and numerous other taxa, most of which have been poorly studied. Additionally, there are 27 species of aquatic snails deemed imperiled by NatureServe that did not meet criteria as P1 or P2 species for this plan.

Invertebrates tend to be disproportionately underrepresented in conservation plans and overlooked by land managers, scientists, and policy makers. Many scientists call for an ecosystem level approach to providing conservation for endangered invertebrates while collecting needed information about the diversity, abundance and distribution of these species. Eventually population data would allow species based actions to be incorporated into management plans to protect specific endangered species (Black et al. 2001).

The lack of information on most invertebrate groups is a serious and significant gap in state and regional wildlife conservation which needs to be addressed. The current information that has been gathered for freshwater mollusks and crayfishes is used in this CWCS to determine which are to be treated as GCN, but it could be argued that similar information is also available for certain other groups, such as marine and estuarine shellfish and crustaceans, terrestrial snails, butterflies, dragonflies, and tiger beetles. Sufficient data exist to assign conservation status to many of these animals, as well as for more obscure species with limited distribution or dependence upon threatened habitats. For example, Alabama has 30 terrestrial snails, five spiders, one harvestman, 40 pseudoscorpions, four



millipedes, 38 beetles, five springtails, two diplurans, four mayflies, three butterflies and moths, four dragonflies and damselflies, one stonefly, three amphipods, two cave shrimp, and one isopod that are ranked by NatureServe (2004b) as globally critically imperiled (G1) or imperiled (G2). Taxa from these groups are not treated as GCN species at this time, but the full list is provided in Appendix 1-4. This CWCS acknowledges both their presence and the future need to include these as GCN species as information grows.

Two federally listed endangered invertebrates, the Alabama Cave Shrimp (USFWS 1989), a crustacean, and Mitchell's satyr (USFWS 1998), a butterfly, exist in the state. Two listed insects, Hine's Emerald Dragonfly (USFWS 1995b) and the American Burying Beetle (USFWS 1991b) are thought to be extirpated from Alabama.

The Gulf of Mexico Fishery Management Council (GMFMC) and Gulf States Marine Fisheries Commission (GSMFC) have existing management plans for several shellfish species. The GMFMC has developed regional Fishery Management Plans for shrimp (GMFMC 1981), Stone Crab (*Menippe mercenaria*) (GMFMC 1979), Spiny Lobster (*Panulirus argus*) (GMFMC and SAFMC 1982), and coral and coral reefs (GMFMC 1982). The GSMFC has regional Fishery Management Plans for oyster (*Crassostrea virginica*) (Berrigan et al. 1991) and Blue Crab (*Callinectes sapidus*) (Guillory et al. 2001). These Fishery Management Plans are supported by Alabama's CWCS and incorporated by reference.

## Plants

Plants are not included as GCN taxa and are excluded from the SWG legislation that presently focuses only on animal species. ADCNR does not have authority for conservation of plants, and there is currently no state-level protection for any native plant other than an Alabama Department of Agriculture harvest regulation for Ginseng (*Panax quinquefolium*). Alabama has roughly 4,000 species of vascular plants, at least 96 of which are globally imperiled (NatureServe 2004b). Unfortunately, plants have traditionally been viewed merely as components of wildlife habitat, and have therefore seldom been granted adequate consideration during conservation planning. While ecosystem-based approaches to conserving GCN animals and their habitats will benefit many sensitive and rare plant species, the lack of legal protection of sensitive components of Alabama's native flora is a significant gap in statewide biodiversity conservation which needs to be addressed.



Pitcher Plants (*Sarracenia leucophylla* x *flava*) Mark Bailey



## **Chapter 2. Wildlife Habitat—Alabama's Ecological Framework**

This chapter provides an overview of Alabama's land and waterscapes, which form the ecological context for the species and habitats in greatest need of conservation (Element 2). The state's climate, physiography, geology and hydrology have led to various ecological classifications, and the condition of Alabama's forests and various waterscapes are described as well. Key habitats then were selected from this foundation. Detailed information about Alabama's existing watershed projects and Outstanding Alabama Waterway Designations are contained in Appendix 2-1.

### ***Climate***

Alabama's stable, mild, humid climate has played a major role in determining the plant and animal assemblages occurring within its borders. Summers have high temperatures around 90°F and lows around 70°, and average winter temperatures range from highs of 45° to 50° and lows of 30° to 40°. Annual rainfall, ranging from 45 to 65 inches, is generally well distributed throughout the year, but the December-March period receives the most rain. Late summer to fall is the driest period.

Alabama's climate has remained fairly stable over long periods of time. A major factor contributing to the state's high biodiversity is its geographical position south of the last great glaciation of 100,000 to 10,000 years ago. During this period Alabama's flora and fauna continued to diversify, giving it a significant "head start" over that of much of the continent which was temporarily eliminated, buried beneath ice.

### ***Alabama's Landscape***

#### ***Physiography***

Over geologic time, roughly two-thirds of present-day Alabama was a shallow sea. Mountains have risen and nearly eroded away, and major rivers have changed course. The resulting physiographic diversity has been a major force behind the natural selection processes that have created new wildlife species, driven others to extinction, and isolated some populations (Mettee et al. 1996). Alabama's physiography is among the most diverse of the southeastern states. Major provinces are the Interior Plateau (or Highland Rim), Southwestern Appalachians (or Cumberland Plateau), Ridge and Valley, Piedmont, and East Gulf Coastal Plain. Each major province is further differentiated into subdivisions representing a variety of physical areas.

#### ***Ecoregions***

The distributional limits of Alabama's species frequently correspond to physiographic boundaries. Harper (1943) noted that Alabama's geological formations influence the soil and topography so directly that a map of Alabama's forest regions does not differ much from the geological map of the state. Howell (1921), Imhof (1962), Mount (1975) and Mettee et al.

(1996) emphasize the influence of physiographic boundaries on the distribution of Alabama's mammals, birds, amphibians and reptiles, and fishes, respectively.

Areas of relative ecological homogeneity—based on physiography, soils, wildlife, vegetation, climate, geology, and hydrology—can be classified as ecoregions. Ecoregions are an effective unit for inventorying and assessing environmental resources, setting regional conservation goals, and developing biological criteria.

The first published map depicting ecological regions of Alabama (as plant distributions and associations) appeared in Charles Mohr's *Plant Life of Alabama* (Mohr 1901). A.H. Howell's *Physiography and Life Zones of Alabama* (Howell 1921) included two of seven transcontinental "life zones," based on altitude and latitude, but Howell also recognized six principal natural divisions of the state, adapted in part from Mohr's map: Mountain Region, Tennessee Valley, Warrior Basin and Tableland, Central Prairie Belt, Coast Pine Belt, and Coast Plain or Gulf Strip. Harper (1943) divided the state into 15 forest regions primarily on the basis of physiography, and Mount (1975) used physiography in delineating eleven "herpetofaunal regions" influencing the distribution of Alabama's amphibians and reptiles.

For terrestrial and estuarine species, this strategy adopts an ecoregional approach to conservation planning, drawing principally from two classification systems. A revision of J.M. Omernik's system which identifies six "Level III" and 29 "Level IV" ecoregions for Alabama (Omernik 1987, Griffith et al. 2001) is used for planning at a coarse-scale level (Figure 2-1). This system is compatible with the species range maps used in Alabama's Second Nongame Wildlife Conference (*Alabama Wildlife*, Mirarchi et al. 2004a, b), and also provides the framework for the Alabama Gap Analysis Program's effort to provide an assessment of the conservation status of native vertebrate species and natural land cover types.

Other ecoregional classification systems have been developed for North America. R.G. Bailey developed a widely-used classification to support ecosystem management on land administered by the U.S. Forest Service (Bailey 1995). Bird Conservation Regions (BCRs), developed by the North American Bird Conservation Initiative (Martell et al. 2002), are another example. The Nature Conservancy's six Alabama ecoregions (Interior Low Plateau, Cumberlands and Southern Ridge and Valley, Piedmont, Upper East Gulf Coastal Plain, East Gulf Coastal Plain, and Northern Gulf of Mexico) are adapted from Bailey (1995) and differ from Omernik's Level 3 ecoregions principally in nomenclature and in 1) treating the Appalachian Plateau and Ridge and Valley as a single unit, 2) separating the Southeastern Plains into two Gulf Coastal Plain units, 3) not treating Omernik's Southern Coastal Plain as a major division, and 4) adding the marine ecosystem.

The following ecoregion descriptions apply to the Griffith et al. (2002) classification depicted in Figure 2-1 and will be used throughout this CWCS.

# Level III and IV Ecoregions of Alabama

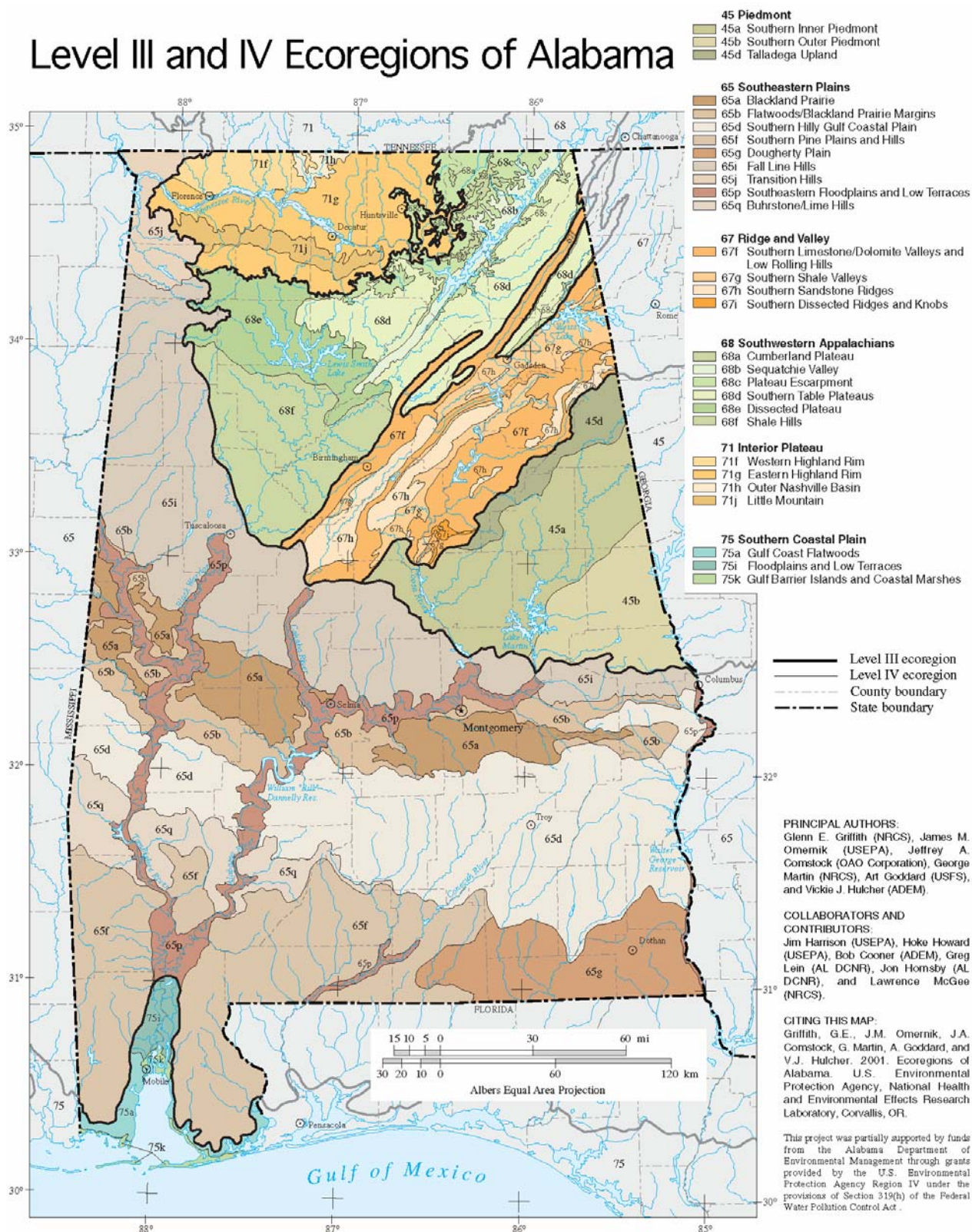


Figure 2-1. Ecoregions of Alabama

**Interior Plateau (IP)**

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The IP is also known as the Highland Rim and Chert Belt. Subdivisions include the Tennessee Valley, Western and Eastern Highland Rim, Outer Nashville Basin, and Little Mountain. Although not indicated, the portion of the Eastern Highland Rim lying south of Little Mountain is known as Moulton Valley. The ecoregion's geology is diverse, and is typically limestone at valley floors (around 500 feet elevation) and sandstone on ridges (to around 1000 feet). Cities include Huntsville, Florence, and Decatur. Most of the region is devoted to farming and industry, and compared with other regions, relatively little natural habitat remains. The entire region is drained by the Tennessee River, and springs and caves are numerous. Important streams include Cypress Creek, Limestone Creek, Shoal Creek, and Elk River. Impoundments on the Tennessee River have virtually eliminated all free-flowing riverine habitats, and the river bears little resemblance to its former state. Forests are predominantly oak-hickory, with some acidic soils supporting Virginia and shortleaf pine. Significant wildlife species of the region include the Gray Myotis, Bewick's Wren, Northern Pine Snake, Hellbender, Spring Pygmy Sunfish, Tuscumbia Darter, Alabama Cavefish, White Wartyback, Rough Pigtoe, and Armored Rocksnail.

**Southwestern Appalachians (SA)**

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The SA is also known as the Appalachian Plateau and Cumberland Plateau. Subdivisions include the Cumberland Plateau, Sequatchie Valley, Plateau Escarpment, Southern Table Plateaus, Dissected Plateau, and Shale Hills. It is composed of plateaus, mountain ridges, hills, and valleys. Soils are derived from sandstone or shale. Elevations range from 600 feet to nearly 1,700 feet. Cities include Jasper, Cullman, and Scottsboro. Most of the Bankhead National Forest lies within the region. Dominant forests are pine-oak, and to a lesser extent, oak-hickory. Most of the coal deposits in Alabama are in this region, and large areas have been altered by strip mining.

Much of the Shale Hills (or Warrior Basin) and Dissected Plateau subdivisions are drained by the upper Black Warrior River and its tributaries: the Locust Fork, Sipsey Fork, and Mulberry Fork. Species endemic to this region include the Flattened Musk Turtle, Black Warrior Waterdog, Warrior, Tuskaloosa, Sipsey, and Rush Darters. Others, such as the Cerulean Warbler and Appalachian Cottontail, occur elsewhere but have their strongholds in the Bankhead National Forest.

The Cumberland Plateau and Plateau Escarpment subdivisions are best represented in Jackson County, and this region is referred to by some authors as the Jackson County Mountains. Here, flat sandstone mountaintops are separated by deep valleys cut into limestone. Ruffed Grouse and Pygmy Shrews are known only from this area of the state. Caves are abundant in the limestone valleys. An important stream is the Paint Rock River, which flows south into the Tennessee River and supports imperiled fishes and mollusks including the Snail Darter, Palezone Shiner, Alabama Lampshell, and Finerayed Pigtoe. Caves in this region are important habitat for the Gray Myotis, Allegheny Woodrat, and Tennessee Cave Salamander.

**Ridge and Valley (RV)**

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The RV is a series of folded parallel valleys and ridges between the Southwestern Appalachians and the Piedmont, extending southwestward from Georgia to the Fall Line. Subdivisions include Southern Limestone/Dolomite Valleys and Low Rolling Hills, Southern Shale Valleys, Southern Sandstone Ridges, and Southern Dissected Ridges and Knobs. Soils are varied, derived from the sandstone ridges and limestone valleys, and range from clay to gravelly loams. Elevations range from 600 to 2,100 feet. Cities include Birmingham, Gadsden, and Anniston. Over half of the region has been cleared of forest, with the remainder largely in mixed oak-pine forest. In Cherokee and Etowah counties of the upper Coosa Valley, sizeable areas of longleaf pine flatwoods formerly occurred, with a flora resembling that of coastal regions (Harper 1943). Mount (1975) noted that portions of the Ridge and Valley supported several amphibians and reptiles of Coastal Plain affinity that are not known to occur elsewhere above the Fall Line (the inland boundary of the Transition Hills, Figure 2-1).

This region is drained by the Coosa and Cahaba rivers. The Coosa River is impounded along most of its length and has lost much of its original biodiversity as a result. The Cahaba River is largely free-flowing, but has suffered from pollution resulting from heavy residential and industrial development in the Birmingham area. Significant wildlife species of the Ridge and Valley include the Southern Hognose Snake, Coldwater Darter, Goldline Darter, and Coosa Creekshell.

**Piedmont (P)**

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This region of mostly rolling hills extends into central Alabama from Georgia. It becomes somewhat mountainous in the Talladega Upland subdivision along its northern boundary with the Ridge and Valley, and contains Alabama's highest point, Mount Cheaha (elevation 2,407 feet). The flora and fauna of this high elevation portion of the Piedmont are somewhat allied to those of Georgia's Blue Ridge, which extends into Alabama ecologically, if not physiographically (Harper 1943, Mount 1975). Longleaf pine grows on the drier ridges, but most of this region is deciduous forest. The Southern Inner Piedmont subdivision is moderately hilly, and the Southern Outer Piedmont subdivision is relatively flat. Elevations typically range from 500 feet to 1,200 feet. Cities include Rockford, Dadeville, and Opelika. Clays and rocky soils are derived from granite, schist, and igneous rock. Soil productivity has been greatly decreased over much of the Piedmont due to poor farming practices in the 1800s and early 1900s. Many areas of depleted soils have reverted back to forest. Where not converted to loblolly pine plantation, ridge tops are predominantly loblolly-shortleaf pine, with hardwoods on the lower slopes and bottomlands. The Piedmont ends abruptly at the Fall Line. Significant wildlife species include the Meadow Jumping Mouse, Wood Frog, Shoal Bass, and Finerayed Pocketbook.

**Southeastern Plains (SP)**

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The SP is also known as the Coastal Plain or East Gulf Coastal Plain. This ecoregion represents over half of the land area of the state, and is highly variable in topography, soils, and vegetation. The Southeastern Plains region is separated from the other regions to the north by the Fall Line, which curves from the northwestern corner of Alabama to the Georgia border in east central Alabama. The Fall Line (inland limit of Transitional Hills, Figure 2-1)

is the most important physical feature affecting the distribution of a number of Alabama's amphibians, reptiles, fishes, and mollusks. Streams above the Fall Line are generally swift, with rocky bottoms. Streams below the Fall Line tend to be sluggish, with muddy or sandy bottoms.

Geologically, this region is much younger than the upland regions and it lacks well-consolidated rocky formations. Most of the soils in this area are derived from marine and fluvial sediments eroded from the Southwestern Appalachian and Piedmont plateaus. Topography is generally flat to gently rolling, but some portions have relief of 200 to 300 feet. Much of the forest in this region has been converted to pine plantations. Where natural forest remains, longleaf, shortleaf, and loblolly pines dominate most uplands, with slash pine in the lower areas and scattered areas of hardwoods. Floodplain forests contain oaks, ash, cypress, and tupelo gum. Prior to modern fire suppression, the upland forests naturally burned every few years and fire-adapted species such as longleaf pine were predominant over much of the area.

### **Subdivisions of the Southeastern Plains**

Eight subdivisions appear in the SP ecoregion as transverse belts or bands, and a ninth is associated with southerly-flowing rivers. From north to south these are the Transition Hills, Fall Line Hills, Blackland Prairie, Flatwoods/Blackland Prairie Margins, Southern Hilly Gulf Coastal Plain, Buhrstone/Lime Hills, Southern Pine Plains and Hills, and Dougherty Plain.

The **Transition Hills** and **Fall Line Hills** region, also known as the Upper Coastal Plain and Central Pine Belt, lies between the Blackland Prairie and the Fall Line. Soils are Cretaceous in origin, ranging from clay to sand and gravel. Streams draining this area rarely go dry, because of the presence of sand and gravel aquifers. In the northwestern part of the region, the transition between the Longleaf pine predominates on the more well drained soils, with hardwoods on the lower slopes.

The **Blackland Prairie**, or Black Belt, extends in a crescent-shaped band across central Alabama. The region is named for the dark, calcareous, chalky soil, which is high in fertility. Most areas are highly alkaline and do not support pines, but eastern redcedar is abundant.

The **Flatwoods/Blackland Prairie Margins** and **Southern Hilly Gulf Coastal Plain**, also called the Chunnenuggee Hills or Blue Marl Region, is a narrow band lying mostly between the Blackland Prairie and the Buhrstone/Lime Hills. Terrain is generally hilly, with sandy loam topsoils over sandy clay to clay subsoil. Loblolly and shortleaf pines predominate in the eastern portion, with post oak historically predominating in the western portion, an area sometimes referred to as the Post Oak Flatwoods.

The **Buhrstone/Lime Hills**, also known as the Red Hills, is a band of fertile soil approximately 30 to 40 miles wide extending from Mississippi to Georgia. Rocky bluffs and deep ravines characterize the region. Ridge tops and upper slopes support longleaf, loblolly, and shortleaf pines, with a mixture of oaks. Bluffs, ravines, and lower slopes are dominated by beech, magnolias, oaks, and hickories. The Red Hills Salamander is restricted to a portion of this region.



The **Southern Pine Plains and Hills** and **Dougherty Plain** have sandy loam, sandy clay, or sandy soils. Most of this region is low in elevation and relatively flat. The fire-adapted longleaf pine community was here before extensive clearing for agriculture, conversion to loblolly plantations, and suppression of fire.

Each ecoregion of the Southeastern Plains contains areas classified as **Southeastern Floodplains and Low Terraces**. These are along larger river systems, including those of the Mobile Bay drainage, the Conecuh River, and the Chattahoochee River.

### **Southern Coastal Plain (SCP)**

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The SCP is also known as the Coastal Strip, and contains the Mobile-Tensaw Delta, coastal flatwoods, marshes, beaches, and barrier islands. The entire area is close to sea level. The Mobile-Tensaw Delta does not resemble a typical delta because it is bounded on the east and west by high ground. It is roughly 10 miles wide and 40 miles long, and consists of rich alluvial soils deposited below the confluence of the Tombigbee and Alabama rivers. Much of the delta has been protected in recent years, but most of Alabama's privately owned beach and dune habitats have been destroyed or heavily degraded by development. Dauphin Island is the largest barrier island. Significant wildlife species of the region include the Gulf Sturgeon, Alabama Beach Mouse, Mississippi Diamondback Terrapin, and Piping Plover.

### ***Alabama's Forests***

With a few exceptions, most terrestrial natural habitats in Alabama are forested. Nearly 23 million acres of forest blanket two-thirds of Alabama's land area. These forests are 45 percent hardwood, 36 percent pine, and 18 percent mixed hardwood-pine (Hartsell and Brown 2002). Longleaf pine, slash pine, loblolly pine, and shortleaf pine are the principal pine species. Plantations comprised 24 percent of the timberland in 2000, with loblolly pine being the principal planted tree. Dozens of hardwood species are present, with oaks and hickories of several species predominating. Although 5.5 million acres have been converted to pine plantations, many areas that once were naturally dominated by pines have succeeded to hardwoods as a result of fire suppression or abandonment of agricultural lands (Boyce et al. 2002).

Human activities have altered Alabama's forested landscapes far more than the casual observer would suspect. In age structure, appearance, and species composition, today's forest is very different from that described by early European settlers. The American chestnut blight in the early 1900s virtually extirpated a dominant and valuable species and drastically changed Alabama's deciduous forests. The once-vast longleaf forests of Alabama and adjacent states, once the backbone of the early timber industry, are now reduced to a fraction of their former extent.

When botanist William Bartram traveled through parts of Alabama and the Southeast in the late 1700s, he described "grassy savannas of scattered longleaf pines, abundant cane, and narrow groves of hardwood forest on the banks of streams" in the Coastal Plain. Fire, whether set by Native Americans or lightning-caused, played a vital role in maintaining the

longleaf pine forests of the region. English naturalist Philip Henry Gosse visited Alabama in the late 1830s and described the "dense wall of towering trees" surrounding villages and plantations, and Black Belt prairies so free of trees that they resembled "clearings made by the axe of the settler" (Gosse 1859). Of the old growth deciduous forest of Dallas County, where he observed Ivory-billed Woodpeckers, Gosse wrote: "There is inexpressible grandeur in these primeval forests. Many of the trees are of immense magnitude, and their trunks rise like pillars from the soft and damp soil, shooting upward in columnal majesty...And thus we see the original forest. The ground is commonly clear of underwood to a remarkable degree, so that it is by no means unusual for hunters to pursue their game on horseback at full speed through these sylvan recesses."

Although Native Americans frequently modified the forest for agriculture, large-scale exploitation of Alabama's forestlands for timber and agriculture began with the immigration of European settlers to Alabama in the early 1800s. The rise of a strong agricultural economy reduced the state's forestlands significantly. Gosse recorded the changing landscape in the 1830s, reporting fields of girdled and dead trees "so thickly spread over the land [that they] look[ed] like an army of skeletons stretching their gaunt, white arms." With the advent of agriculture, cleared land was often worth more than forested land, and by the early 1900s, much of the original forest had been cleared of trees.

After 1850, railroads began rapidly expanding in the South, and they consumed vast quantities of wood for ties, cars, fuel, bridges, and trestles. Each mile of track required over 2,500 crossties that had to be replaced every five to seven years (Burdette 1995). Much of the timber produced in Alabama before the Civil War was milled into lumber for local use. After the war, reconstruction of damaged and destroyed buildings and infrastructure increased the demand for lumber and the number of sawmills multiplied. Depleted forests in the Northeast also created markets for southern timber. The rich, vast stands of centuries-old longleaf pine drew the nation's lumber industry to Alabama and the Southeast. By the 1880s, sawmills were the dominant industry in the South (Burdette 1995). Narrow gauge tram lines, improvements in steam-powered sawmill machinery, and other technological advances hastened the liquidation of Alabama's standing timber. "Cut out and get out" logging practices were widespread and wasteful.

By the late 1920s the old-growth forests were virtually gone, and millions of acres were cleared or degraded. Concern for the future of Alabama's forest was growing, and the Alabama Forestry Commission was established primarily as a fire control agency. Fire control, along with laws passed to eliminate free ranging livestock, encouraged the regeneration of Alabama's forests.

In the 1930s the Agricultural Conservation Program (ACP) was established to assist farmers in converting marginal farmlands to forestlands. Also during this period, the U.S. Forest Service began purchasing lands. Most lands acquired by the government were "worthless," worn-out farmland or cut-over and burned former forestland. The Civilian Conservation Corps (CCC) planted hundreds of thousands of trees on these lands and created recreation sites.



After the Second World War, the pulp and paper industry grew rapidly in Alabama, taking advantage of the under-utilized native pines and low-grade hardwoods. During the next 40 years, industry purchased large tracts of forestland to intensively manage for wood fiber to satisfy future raw material demand. During this same period, agricultural areas were abandoned and fire control was improved, resulting in many old fields reverting back to forest.

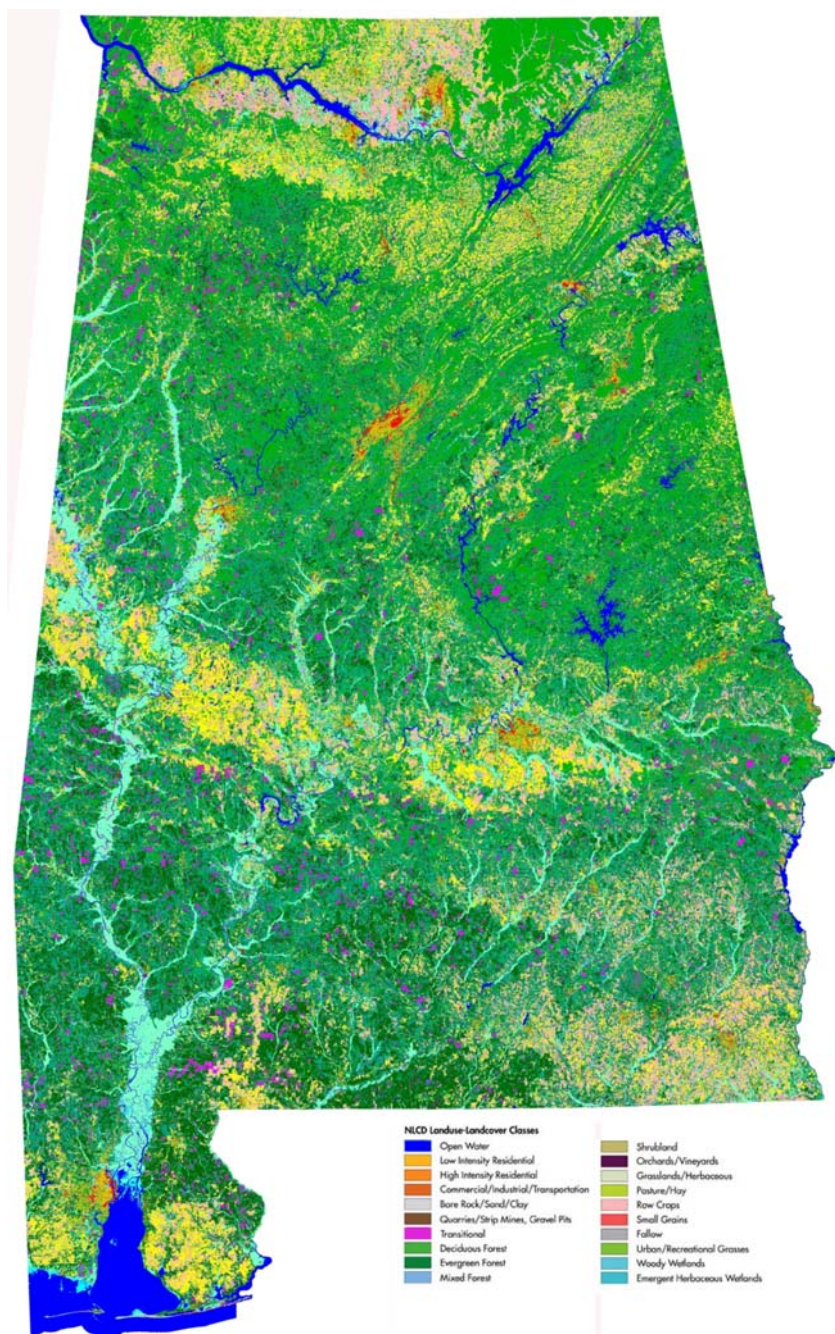
Today, most of Alabama's private forestlands are maintained with economic return from sale of timber as either a primary or secondary objective. Other major uses of private forestlands are as habitat for native game species and for hunting. Alabama's forests and the industry they support contribute in excess of \$5 billion to the state's annual economy, and Alabama's forest industry directly provides employment for 66,800 people. The forest products industry is the largest industry in Alabama, and timber is the dominant crop harvested in more than half (34) of the state's 67 counties

As a satellite image of Alabama shows (Figure 2-2), losses of forested lands are most conspicuous near the coast, in the southeastern "Wiregrass" region, on Sand Mountain and in the Tennessee Valley. The expanding metropolitan areas of Huntsville, Birmingham, Tuscaloosa, Anniston, Montgomery, Mobile, and Dothan are clearly visible.

### ***Beneath the Surface***

Over 4,000 caves have been documented in Alabama, with most in the northeastern quadrant. Caves are of tremendous importance to many species, including mammals, amphibians, fishes, crustaceans, insects, arachnids, and other invertebrates. Hundreds of animals have evolved to survive in these dark, damp, stable habitats, and many species are known from only one or two caves. Jackson County alone harbors 24 obligate cave species that exist no place else (NatureServe 2004b). Newsome Sinks Karst Area (Morgan County), Shelta Cave (Madison County), and Cathedral Caverns (Jackson County) have been designated as National Natural Landmarks ([www.nature.nps.gov/nnl/](http://www.nature.nps.gov/nnl/)). Studies by Dr. David Culver and others at the Karst Waters Institute have identified northeast Alabama as one of the major "hotspots" for cave animal diversity in the United States (Figure 2-3).

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**Figure 2-2. Vegetation Cover and Land Use of Alabama**

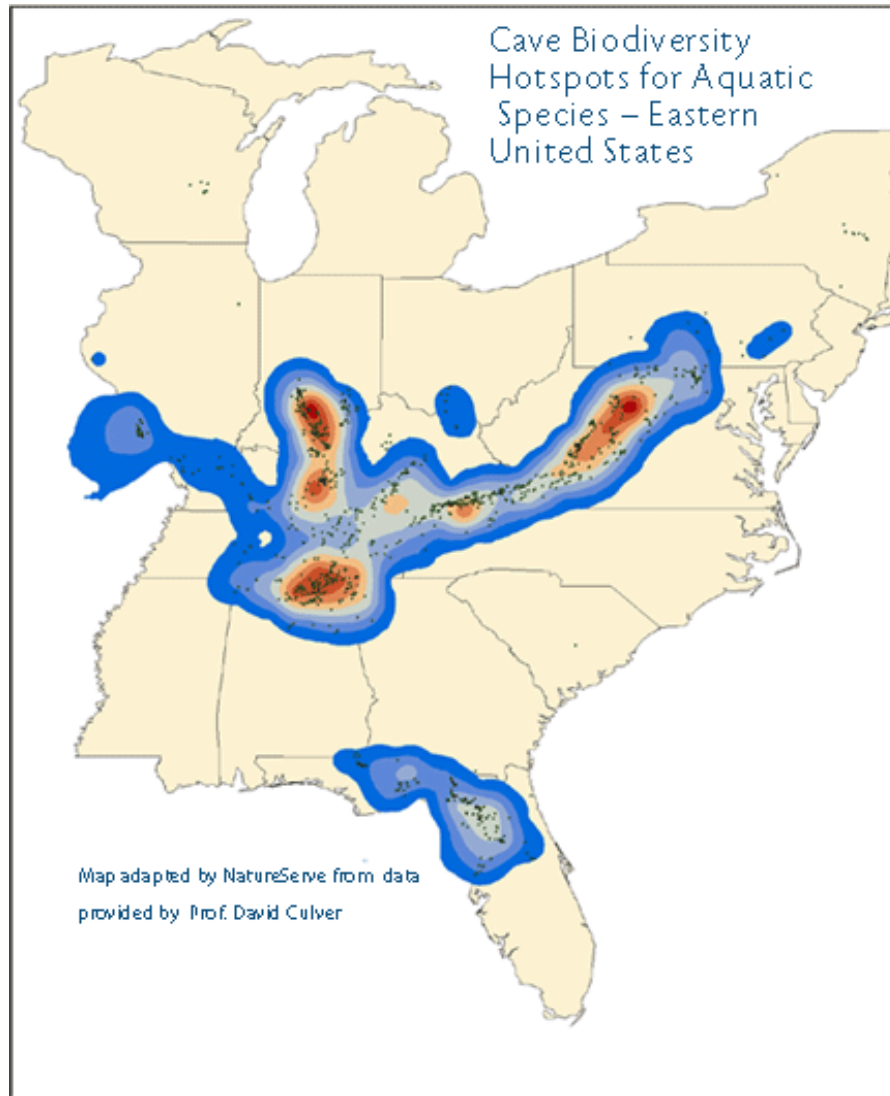


Figure 2-3. Cave Biodiversity Concentrations of the Eastern U.S.

### ***Alabama's Waterscape***

Alabama has abundant water resources. The state's average annual rainfall of 55 inches supplies the water for over 77,000 miles of perennial and intermittent streams (Figure 2-4); 563,000 acres of ponds, lakes and reservoirs; and over 3 million acres of marshes and wetlands. In addition, Alabama has over 50 miles of coast with over 400,000 acres of estuaries, which are influenced directly by rainfall and stream flow. This diversity of habitats supports a corresponding diversity of wildlife (Mettee et al. 1996).

Chapter 2: Wildlife Habitat

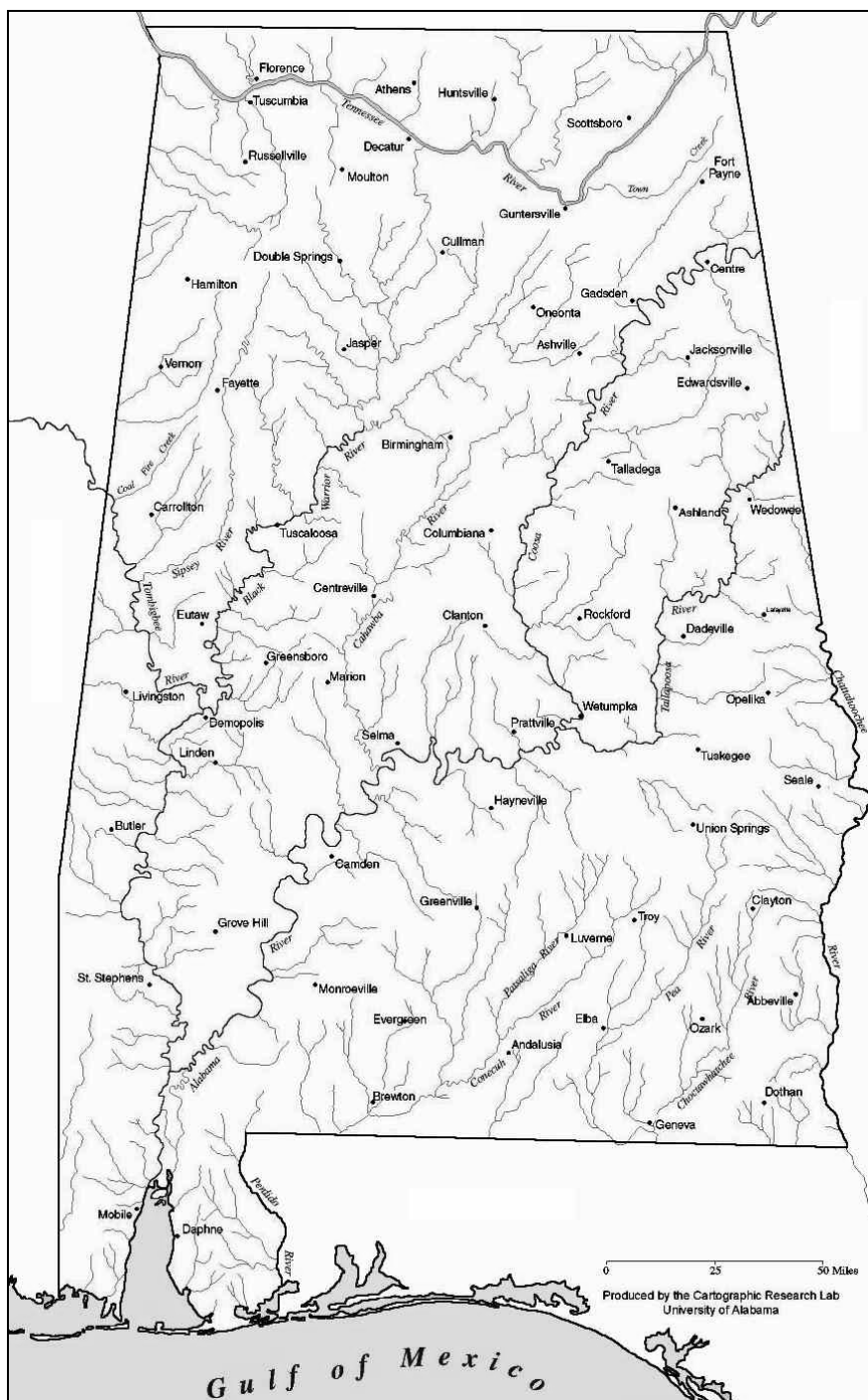


Figure 2-4. Major Alabama Rivers and Tributaries

### ***Rivers and Streams***

About 60 percent of Alabama's streams flow year-round and the remainder flow intermittently. Most larger rivers have been impounded for navigation, hydropower and flood control, resulting in the loss of many species (Mettee et al. 1996). The Tennessee, Chattahoochee, and Mobile basins are the major watersheds in the state. Additional Gulf drainages include the Conecuh, Choctawhatchee, Yellow, Escatawpa, Perdido, and Blackwater rivers.

Some of Alabama's rivers and streams are noted for their uniqueness. The upper Sipsey Fork of the Black Warrior River was granted Wild and Scenic River status in 1988, and it is also known for harboring exceptional biodiversity. The Cahaba River has been designated one of North America's eight river "Biodiversity Hotspots" by The Nature Conservancy (TNC). The Paint Rock River is a free-flowing tributary of the Tennessee River. The Paint Rock watershed is one of the most biologically important regions in the state for both aquatic and terrestrial species. The river supports 100 species of fish and about 45 mussels, two of which are found nowhere else in the world (NatureServe 2004b). Portions of Little River, Sipsey Fork, Cahaba River, Hatchet Creek, and Tensaw River are designated Alabama Outstanding Waters (Appendix 2-1).

Incidence of GCN species by river basin is a reflection of overall aquatic biodiversity and the cumulative anthropogenic impacts to each basin. Aquatic biodiversity is greatest in the Tennessee River basin, which TNC describes as the most biologically diverse river basin in North America. This is followed by the primary drainages of the Mobile basin (Coosa, Cahaba, Black Warrior and Tombigbee). Endemism is also high in these basins. For example, Boschung and Mayden (2004) identify 42 fish species endemic to the rivers of the Mobile basin.

Relative condition of Alabama's river basins is primarily related to dam construction and conversion of forests to agricultural, intensive silvicultural, mined, and urban landscapes. Low head dams were constructed on several rivers prior to 1900 to aid navigation. During the 20<sup>th</sup> century, these dams were replaced by larger structures and the system expanded, so that today Alabama leads the nation with 1,438 navigable miles controlled by 16 lock and dam structures (Mettee et al. 1996). In addition, some large hydroelectric dams were constructed, primarily by Alabama Power Company (APC), that do not include navigation locks. Many of Alabama's largest dams were constructed between 1916 and 1939, including one on the Tallapoosa River, three on the Coosa River and all four on the Tennessee River. Another flurry of building occurred during the 1960's. No new major dams have been constructed since 1983. Currently most hydroelectric facilities are operated to provide peaking power and no major Alabama dam includes a dedicated fish passage.

Table 2-1 summarizes water quality, land use and GCN species occurrence by river basin. Aquatic species of the Tennessee River basin account for about one-third of all Alabama GCN species (aquatic and terrestrial combined) including a very high number of extirpated species. This high incidence of GCN species is related to impoundment of the Tennessee River and some tributaries (Elk River and Bear Creek system). In addition, the

Tennessee basin has the lowest percent of forest cover and highest percent of agricultural lands of any Alabama basin, resulting in 650 miles of impaired streams.

Most of the other primary Alabama drainages (Tombigbee, Black Warrior, Alabama, Coosa, Tallapoosa and Chattahoochee) are also impounded and although they are not as species rich as the Tennessee basin, they exhibit a similar pattern of GCN species occurrence and extirpation. However, forest cover is relatively high in these basins and they have a low incidence of impaired streams, except the Black Warrior basin which encompasses a portion of the Birmingham metropolitan area and includes 4 percent mined lands (no other basin includes more than 1 percent mined lands).

The Cahaba River basin, the remaining primary Mobile basin drainage, is unimpounded. However, this extremely species rich basin has been impacted by the rapid urbanization of the upper watershed (Birmingham metropolitan area).

The remaining coastal basins are not as species rich, include few metropolitan areas and remain largely unimpounded. As a result, their faunas are largely intact and they harbor fewer GCN species.

**TABLE 2-1. CONDITION AND STATUS OF ALABAMA'S MAJOR RIVER BASINS**

BASIN	ALABAMA AREA (miles <sup>2</sup> )	IMPAIRED STREAMS (miles)	NUMBER OF AQUATIC GCN SPECIES		MAJOR LAND USES (%)		
			HISTORIC	CURRENT	FORESTED	AGRICULTURAL	URBAN
Tennessee	6826	650	101	76	49	41	5
Coosa	5353	62	47	29	70	19	5
Cahaba	1818	185	47	35	65	15	16
Black Warrior	6276	470	38	29	62	22	8
Alabama	5956	62	31	23	68	26	4
Tombigbee	7660	16	30	27	78	16	2
Chattahoochee	2832	37	27	24	66	25	5
Conecuh	3848	53	19	18	81	15	2
Choctawhatchee	3130	20	17	17	54	39	4
Tallapoosa	3974	92	16	11	73	17	4
Yellow	507	0	16	15	71	24	3
Mobile	1013	207	15	15	63	14	18
Escatawpa	767	97	12	12	71	21	6
Blackwater	148	0	8	8	80	18	0
Perdido	841	32	7	7	69	19	7



The status and distribution of each of the 15 river basins is provided in Chapter 4. This analysis evaluates the relative ecological condition of each basin. Any exemplary sites and priority areas within the basins have also been identified by ADCNR staff, expert advisory committees, and stakeholders. This information, combined with the wildlife species of GCN, was used to guide the identification and prioritization of conservation actions.

### ***Lakes and Ponds***

Alabama has few large natural lakes, but 42 public impoundments, totaling nearly one-half million acres, are larger than 500 acres. In addition to these, DWFF manages 23 public fishing lakes in 20 counties throughout the state. These lakes range in size from 13 to 184 acres for a total of 1,912 surface acres (ADCNR 2004).

Most large Alabama reservoirs are managed by the Tennessee Valley Authority and the U. S. Army Corps of Engineers for navigation, flood control, hydropower and recreation and by Southern Company (Alabama Power and Georgia Power) for hydropower, flood control and recreation.

Thousands of small farm ponds are scattered across the state. Most are impounded headwaters of small streams, but some are excavated catch basins. Many such ponds are managed for recreational fishing. Beaver ponds are a common feature in the landscape, and provide important habitat to waterfowl, fish, amphibians, reptiles, and other wildlife.

### ***Estuaries and Marine Habitat***

Alabama's marine area is important for commercially and recreationally valuable fisheries, as well as other finfish, crustaceans, shellfish, marine mammals, sea turtles, seabirds, and waterbirds. Mobile Bay is Alabama's largest estuary, encompassing 264,470 acres of water and 142 miles of shoreline (Crance 1971, as cited in GMFMC 1998). The bay is the mouth of the Mobile Basin, which is the nation's sixth largest watershed by area and fourth largest in terms of discharge volume. Ecosystems associated with Mobile Bay include barrier islands, tidal marshes, cypress swamps, bottomland hardwoods, submerged aquatic vegetation (SAV) and oyster reefs. The average water depth in Mobile Bay is approximately 10 feet and the tidal marshes are located mostly at the northern end of the bay and along the shores of its tributary estuaries (Crance 1971, as cited in GMFMC 1998).

The Mobile Delta estuary is made up of a series of rivers, shallow bays and numerous interconnecting marshes and streams. Averaging about 11 feet in water depth and with 20,323 acres of open water, there are 55.4 miles of bay shoreline and in 1971 there were 15,257 acres of tidal marsh in the estuary (Crance 1971, as cited in GMFMC 1998). The current distribution of SAV is unknown for both estuaries but includes shoal grass (*Halodule wrightii*), southern naiad (*Najas guadalupensis*), wild celery (*Vallisneria spiralis*), slender pondweed (*Potamogeton pusillus*), *Nitella* spp. and widgeon grass (*Ruppia maritima*). Shoal grass is the dominant seagrass in Alabama (GMFMC 1998).

Weeks Bay is a small estuarine embayment, off of Mobile Bay, and consists of approximately three square miles of open shallow water, averaging 4.5 ft. deep. Weeks Bay is fringed with marsh (*Spartina* spp. and *Juncus* spp.) and swamp (oak, maple, cypress and others). Forested wetlands form an extensive strip between floodplain swamps and upland pine-oak forest. Weeks Bay is a critical nursery for fish, crustaceans and shellfish, is classified as an Outstanding Alabama Water, and is designated a Habitat Area of Particular Concern (HAPC) by the Gulf of Mexico Fishery Management Council. The GMFMC describes Alabama's estuaries as "important in sustaining viable fisheries [throughout] the Gulf of Mexico" (GMFMC 1998).

Alabama's jurisdiction extends three miles from the coastline offshore into the Gulf of Mexico and includes marine benthic (including submerged seagrasses), pelagic and surface water ecosystems. The Mississippi-Alabama shelf extends from the Mississippi River delta to the west to DeSoto Canyon offshore Pensacola, Florida, to the east. The inner shelf seafloor is relatively broad and flat to the west of Mobile Bay but characterized by sand ridges and swales east of the bay; a deepwater navigation channel bisects the underwater tidal delta directly off Mobile Pass. Several hardbottom areas of exposed rock occur in between 60 and 130 feet of water south of Mobile Pass and at the Alabama-Florida state boundary, creating several "reef-like knobs" of 1.5 to 16 feet of vertical relief (GMFMC 1998).

Alabama's marine area also contains nearly 1,260 square miles (806,400 acres) approved for the construction of artificial reefs in the nation's first and largest organized artificial reef program. Artificial reefs have been built in up to 2,760 feet of water and up to 56 miles offshore, consisting of vessels, concrete rubble, oil platforms, obsolete military tanks, boxcars, airplanes, barges, oyster shells, rock and other materials (GMFMC 1998). Two hundred and fifteen offshore reefs have been constructed so far. The ADCNR has constructed 13 inshore artificial reefs within Mobile and Bon Secour Bays and Mississippi Sound through the Roads to Reefs partnership that recycles bridge materials as artificial reef habitat.

## ***Wetlands***

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland soils (U.S. Environmental Protection Agency 1995).

Approximately 3.5 million acres of wetlands exist in Alabama, but development, agriculture, draining, and other human activities have destroyed more than half of the estimated 7.5 million acres that were present before European settlement (Phillips 2002, Mitsch and Gosselink 1993). The types of wetlands found in the state are varied and include salt marsh, forested swamps, and bogs. The tidally influenced Mobile-Tensaw Delta north of



Mobile Bay is the state's largest wetland, and ranges from 5 to 10 miles wide along its 40-mile length.

### ***Ecological Systems and Habitats***

While ecoregions are a useful coarse-filter approach to managing biodiversity information, a finer level of precision is required for many conservation applications. *Ecological systems* are defined as groups of plant community types that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients (NatureServe 2004c). A given ecological system will typically manifest itself in a landscape and persist for 50 or more years. Ecological system units are intended to provide "meso-scale" classification units for applications to resource management and conservation. The use of these standardized, named vegetation community systems, also called habitats, facilitates compilation of regional and national map and inventory data. For many wildlife species, the lack of distribution and abundance data requires the use of key habitats and associated vegetative communities as the best available scale for appropriate conservation planning and implementation.

Applications of ecological systems as key wildlife habitats include their use as units for conservation assessment, ecological inventory, mapping, land management, ecological monitoring, and species habitat modeling. With the possible exception of caves, these habitats have not yet been fully mapped at a fine scale in Alabama. This has been identified as a critical gap and has been captured as a conservation priority to meet this need to improve habitat information.

### ***Identifying Habitats***

NatureServe (2004c) has classified and described 66 ecological systems in Alabama based on the National Vegetation Classification (NVC). The NVC is the standard vegetation classification system for federal agencies (FGDC 1997) and it has received widespread support from state, federal, academic, and international partners (Jennings 1993, Loucks 1996, FGDC 1997). This classification serves many natural resource management purposes including conservation planning, biodiversity protection, scientific research, inventory, and mapping (NatureServe 2004a), and was recommended by the International Association of Fish and Wildlife Agencies (IAFWA) Teaming with Wildlife Committee for regional and national consistency in the development of Comprehensive Wildlife Conservation Strategies. The SLD-NHS database, Forever Wild's Natural Heritage Plan, and The Nature Conservancy also use this classification.

As with the identification of GCN wildlife species discussed in Chapter 1, the identification of key habitats involved input and analysis/review by DWFF staff, scientific advisory committees, and stakeholders. Using information from the existing classification systems discussed above, an initial list of habitats important to wildlife in Alabama was developed. This list was then crosswalked with the NVC and NatureServe ecological systems (Table 2-2) as suggested by the IAFWA committee for regional and national consistency. DWFF staff and the scientific advisory committee reviewed this foundational database for refinement and completion of missing data.

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**TABLE 2-2. HABITATS AND ASSOCIATED COMMUNITIES**

Habitat	No. GCN Species	Associated NatureServe Ecological Systems
Mesic Hardwood Forest	30	Southern Piedmont Mesic Forest CES202.342 South-Central Interior Mesophytic Forest CES202.887 East Gulf Coastal Plain Southern Mesic Slope Forest CES203.476 East Gulf Coastal Plain Northern Mesic Hardwood Forest CES203.477 East Gulf Coastal Plain / Central Florida Hydric Hammock CES203.501 East Gulf Coastal Plain Limestone Forest CES203.502 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods CES203.557
Dry Hardwood Forest	30	Southern Piedmont Dry Oak-(Pine) Forest CES202.339 Allegheny-Cumberland Dry Oak Forest and Woodland CES202.359 Southern Ridge and Valley Dry Calcareous Forest CES202.457 Southern Interior Low Plateau Dry Oak Forest CES202.898 East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest CES203.506 East Gulf Coastal Plain / Central Florida Upland Hardwood Forest CES203.560
Floodplain Forest	29	Cumberland Riverscours CES202.036 Southern Piedmont Small Floodplain and Riparian Forest CES202.323 Southern Piedmont Large Floodplain Forest CES202.324 South-Central Interior Large Floodplain CES202.705 South-Central Interior Small Stream and Riparian CES202.706 East Gulf Coastal Plain Large River Floodplain Forest CES203.489 East Gulf Coastal Plain/Cent. FL Blackwater Riv. Floodplain Forest CES203.493 East Gulf Coastal Plain Small Stream and River Floodplain Forest CES203.559
Wet Pine Savanna and Flatwoods	29	East Gulf Coastal Plain Near-Coast Pine Flatwoods CES203.375 East Gulf Coastal Plain Treeless Savanna and Wet Prairie CES203.192
Dry Longleaf Pine Forest	28	Southeastern Interior Longleaf Pine Woodland CES202.319 East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland CES203.496
Swamp	25	Southern Piedmont Upland Depression Swamp CES202.336 East Gulf Coastal Plain Tidal Wooded Swamp CES203.299 East Gulf Coastal Plain Non-riverine Basin Swamp CES203.384 East Gulf Coastal Plain / Central FL Seepage Swamp and Baygall CES203.505
Maritime Forest and Coastal Scrub	21	East Gulf Coastal Plain Maritime Forest CES203.503
Glades and Prairie	15	Southern Piedmont Glade and Barrens CES202.328 Southern Piedmont Granite Flatrock CES202.329 Cumberland Sandstone Glade and Barrens CES202.337 Alabama Ketona Glade and Woodland CES202.338 Southern Ridge and Valley Patch Prairie CES202.453 Central Interior Highlands Calcareous Glade and Barrens CES202.691 East Gulf Coastal Plain Black Belt Calcareous Prairie and Woodland CES203.478
Bogs and Seepage Communities	15	Southern Piedmont Seepage Wetland CES202.298 Cumberland Seepage Forest CES202.361 East Gulf Coastal Plain Herbaceous Seepage Bog CES203.078 East Gulf Coastal Plain Interior Shrub Bog CES203.385
Caves and Mines	14	N/A
Isolated Wetland	13	Cent. Interior Highlands & Appalachian Sinkhole & Depression Pond CES202.018 Atlantic and Gulf Coastal Plain Interdunal Wetland CES203.258 East Gulf Coastal Plain Northern Depression Pondshore CES203.558
Artificial Habitats	13	N/A
Beach and Dune	12	Florida Panhandle Beach Vegetation CES203.266 East Gulf Coastal Plain Dune and Coastal Grassland CES203.500
Estuarine and Marine	12	East Gulf Coastal Plain Northern Gulf of Mexico Seagrass Bed CES203.263 Mississippi Sound Salt and Brackish Tidal Marsh CES203.303
Cliffs and Rockhouses	6	Southern Interior Sinkhole Wall CES202.357 Southern Appalachian Spray Cliff CES202.288 Southern Interior Acid Cliff CES202.309 Southern Appalachian Montane Cliff and Talus CES202.330 Allegheny-Cumberland Sandstone Box Canyon and Rockhouse CES202.349 Southern Interior Calcareous Cliff CES202.356 Southern Piedmont Cliff CES202.386 East Gulf Coastal Plain Dry Chalk Bluff CES203.492

## Chapter 3. Major Statewide Conservation Issues and Threats

While Chapter 1 summarized the fish and wildlife species of Alabama and Chapter 2 summarized its ecological context and key habitats, this chapter identifies the threats and issues facing both GCN species and key habitats. Some of these threats are pervasive and statewide, but others are species- or habitat specific.

### ***Identifying Threats to Alabama's Wildlife and Key Habitats***

Threats to species of GCN were identified, assessed, and prioritized in several ways (Element 3). Volumes 2-4 of *Alabama Wildlife* were primary sources. Threats assessments by other agencies and stakeholders were also used. For example, TNC's Priority Areas for Freshwater Conservation (Smith et al. 2002) provides detailed and site-specific threats and recommended conservation actions (see Chapter 4) for the Tennessee-Cumberland, Mobile Basin, and Mississippi Embayment drainages in Alabama. TNC's Threats Assessment and Viability Analysis for its ecoregional target species were reviewed and integrated for each of Alabama's five ecoregional plans.

The foundation for the process of identifying problems impacting those species and habitats identified as GCN during this Alabama CWCS planning process was a compilation of over 60 existing conservation programs and plans, from an exhaustive literature search, and represented a long-established knowledge base and expertise. The summary of sources (Appendix 1-1) lists the major state, regional and national resources used in this threats identification. Some resources were focused on species or taxa, while others were focused on the ecosystem (ecoregion or vegetative community) levels.

The following general threats recurred in multiple plans and stakeholder input closely parallel those threats identified in *Alabama Wildlife*. Codes in brackets (i.e., S23) refer to the recommended Statewide Conservation Actions presented in Chapter 4 to specifically address these threats.

#### **1. Habitat Loss and Fragmentation**

- *Urban and suburban development associated with increasing human population* [S11, S16, S27, S33, S36]
- *Impoundment of remaining free-flowing rivers and streams* [S24, S26]
- *Loss of extensive forested natural communities to development, conversion of natural forest to intensively managed pulpwood plantations and/or agriculture* [S11, S13]
- *Road construction* [S18, S21]
- *Loss of and impacts to natural habitats due to lack of information dissemination and outreach to land-use decision makers, planners, partner public agencies and the public* [S1, S2, S3, S10, S22]

#### **2. Loss of Natural Community Integrity [S12]**

- *Activities that alter flow or temperature regimes in large streams and rivers* [S24, S25, S32]

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- *Activities such as in-stream and streamside mineral extraction, vehicular traffic, and other disruptions to streambeds that prevent natural movement of sand and gravel in streams [S29]*
- *Activities such as stream de-snagging that prevent the natural development and movement of woody and rocky structure [S30]*
- *Activities that destroy or impede the natural development of native stream bank vegetational composition and structure [S31]*
- *Activities such as channelization that destroy or impede natural processes such as bank dynamics, channel meanders, and flood regimes [S17, S32]*
- *Loss of native community structure and composition due to fire suppression [S12, S13]*
- *Lack of old and dead trees, and woody debris decomposing naturally on the ground [S13, S14]*
- *Activities that destroy or damage contiguous gradients (ecotones) from one habitat to another [S11, S18]*

**3. Impacts from Disturbance**

- *Point-source (industrial, municipal, agricultural) and non point-source (residential, silvicultural, agricultural) pollution in waterways [S15, S16, S27]*
- *Improper use of fertilizers, herbicides, and pesticides near streams and wetlands [S19, S33]*
- *Excessive soil disturbances from thinning, harvesting, and site preparation activities [S15, S21]*
- *Erosion from logging, grazing, development, mechanized vehicle trails, horse trails, and other activities uphill from biologically significant sites [S15, S16, S17, S21]*
- *Failure to identify and protect critical and unique habitats embedded in a forest matrix. [S11, S17]*
- *Allowing foot traffic (trails) through sensitive habitat features such as seeps, ravines, coves, etc. [S17, S21, S23]*
- *Placement of new wildlife openings within natural areas without regard to impacts on nongame species [S20]*

**4. Impacts from Exotic Species**

- *Introduction of exotic plant and animal species [S15, S19, S20, S21, S28]*
- *Failure to eradicate or control exotic plant and animal species [S13, S19]*

**5. Lack of Adequate Protection or Information**

- *Insufficient conservation-related educational outreach about biologically significant areas to discourage collecting, poaching, or indiscriminate killing of wildlife by boaters, fishermen, and other recreational users of Alabama's rivers and streams [S10, S21, S22, S34, S36]*
- *Insufficient regulation of collection and harvest of nongame species, including rattlesnake roundups and associated activities such as "gassing" tortoise burrows [S4, S7, S22, S34]*
- *Insufficient policy and programs to adequately protect Alabama's wildlife and habitat [S4, S5, S6, S8, S9, S10, S22]*
- *Lack of information to make science-based decisions to protect Alabama's wildlife and habitats [S1, S2, S3, S4, S5, S6, S8, S9, S10]*

Results were compiled and an additional input solicitation was made to the Scientific Advisory Committee (6 taxa committees representing species experts and major conservation stakeholder groups) and DWFF staff. Some threats were found to be specific to one habitat or applied only to closely related habitats, while others emerged from this process as problems common to most if not all habitats across Alabama.

There was clear consensus that the primary threat to species of GCN statewide is the historic and ongoing loss and degradation of wildlife habitat, largely due to development pressures related to Alabama's increasing human population. Alabama has a population in excess of 4,447,100, a 10.1% increase in population from 1990 to 2000. The cities of

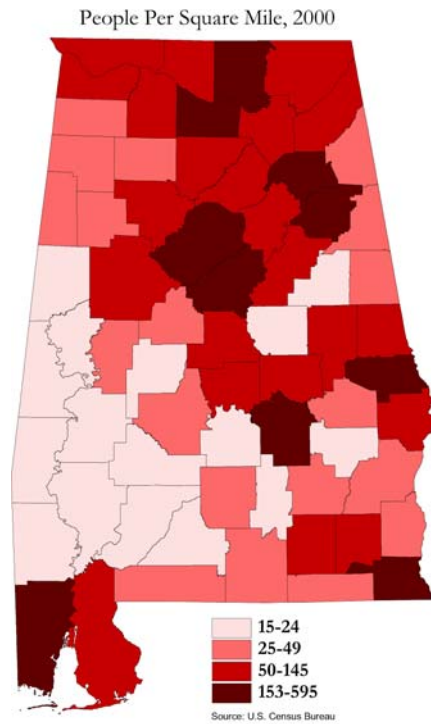
Birmingham, Huntsville, Montgomery, Mobile, and their surrounding suburbs contain approximately half of Alabama's population. The U.S. Census Bureau estimates that by the year 2025 Alabamians will number 5.22 million, a 17 percent increase from 2000 (Campbell 1997). Figures 3-1 and 3-2 represent current population density and areas of population change, respectively. While most counties experienced population growth during the 1990s, many areas of the state are experiencing slow growth. Those areas with slow growth or a net population loss may offer unique opportunities for conservation before population pressures increase in the future.

Impacts from exotic species and fire suppression were noted as high priority concerns. Also, several emerging factors in private land ownership are negatively impacting forests and other terrestrial habitats. These include fragmentation of ownerships, forest type conversion, and sprawling development (Best and Wayburn 2001). Impacts to aquatic species and their habitat include: impoundment of free flowing streams and rivers, habitat degradation from erosion and sedimentation, misuse of fertilizers, pesticides and herbicides, toxic chemicals from point and non-point sources of pollution and competition from exotic species.

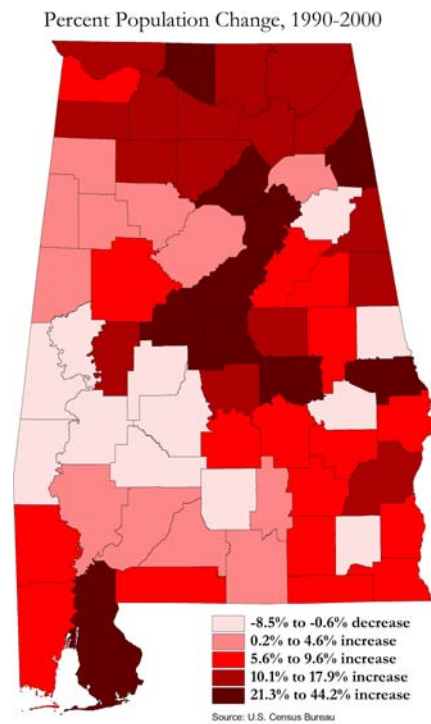
Most of Alabama's terrestrial wildlife species occur in forested habitats, and approximately 95% of Alabama's 23 million forested acres are in private ownership (Boyce et al. 2002, Figure 3-3). Alabama's forests contain significant and biologically diverse natural communities in need of long-term protection and management, but the state's growing and expanding population has and will continue to place pressures on landowners to convert their forestlands to other uses that are in conflict with important natural resource values and benefits. Even land devoted to growing trees has undergone drastic alteration. Over the past 50 years, one of the largest changes in the private forests of the United States has been the substantial decrease in the area of natural pine and the rapid increase in the area of planted pine in the South (U.S. Forest Service 2000).

The pattern of ownership known as urban sprawl, combined with activities associated with increased numbers of people in close proximity to natural lands, creates "rural/urban interface" problems and threats to Alabama's wildlife. The rural/urban interface is a generalized area, often on the fringe of an urban area, where people establish residence. Forestland in the vicinity of major urban centers and larger towns is more likely to be affected. Such areas are characterized by the intermingling of home sites with forest and agricultural lands and the activities associated with each land use. Special problems encountered in the rural/urban interface include increased risk of forest and structural fires, problems with smoke generated by prescribed fires, and stresses imposed on the environment caused by increased numbers of people in close proximity to forestlands and streams. With residential and commercial development, hydrologic changes occur as greater areas of paved impervious surfaces are created, and as first and second order streams are straightened and realigned—referred to as "drainage." Such changes in stream hydrology are one of the most serious issues facing aquatic ecosystems in Alabama. As water velocities and flood frequencies increase, the streams become incised and start a long-term pattern of bank erosion, sediment mobilization and readjustment, all of which

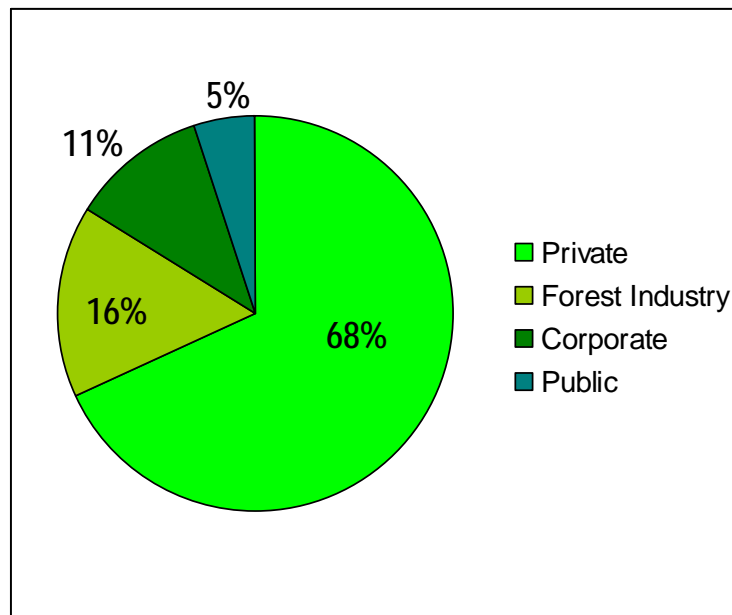
Chapter 3: Conservation Issues and Threats



**Figure 3-1. Alabama's Population Density**



**Figure 3-2. Recent Population Changes**

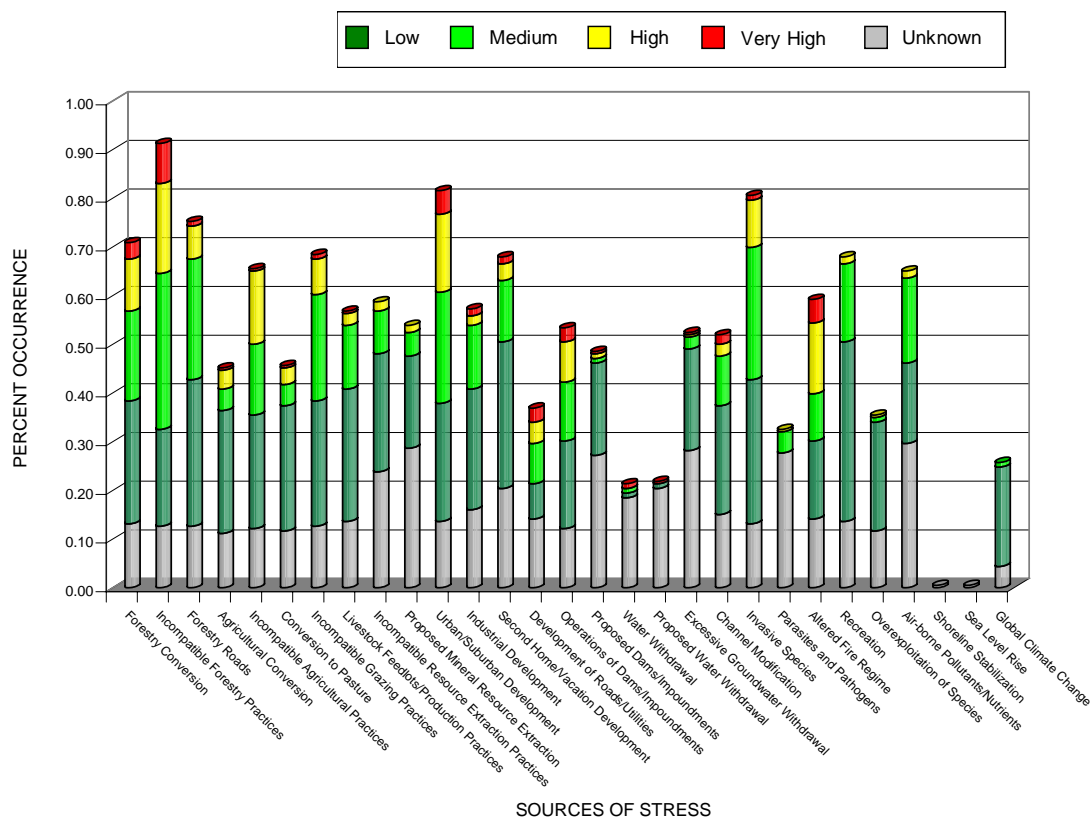


**Figure 3-3. Forest Ownership in Alabama**

also has a detrimental impact on stream biota for many miles downstream (the problem of “sedimentation” in streams from development is not just a simple matter of sediment-laden run-off from construction sites – much of the mobilized sediment in streams is a direct result of an increase in water velocity that de-stabilizes the stream channel.) Changes in upstream land use and hydrology also affect stream temperature patterns, and the sources and types of carbon inputs into aquatic systems, which in turn have a profound impact on patterns of aquatic biodiversity.

Figure 3-4 represents the most comprehensive threats assessment that has been conducted on a large scale in Alabama, incorporating sources and severity of stress on over 200 Nature Conservancy conservation areas statewide. Smaller scale threats assessments exist for a few watersheds, but for the most part are lacking and are recognized as a need to be addressed by ADCNR and its partners.

This CWCS process identified loss of habitat value for aquatic wildlife through increased sedimentation and pollution from adjacent land use changes/development as one of the primary, overarching threats across many watersheds within Alabama. Hydrologic impacts, such as increased new roads, impervious surfaces and culverts from development, etc. were additional important multi-habitat problems needing conservation action.



**Figure 3-4. Sources of Stress on TNC Conservation Areas**

Trends in water quality and aquatic life of rivers and streams have been monitored through the efforts of ADCNR, Geological Survey of Alabama (GSA), ADEM, Alabama Water Watch (AWW), and other agencies and groups. DWFF's Alabama Reservoir Management Program collects baseline information on the fish populations of all large public reservoirs to develop and update management plans for each reservoir (ADCNR 2004). GSA biologists also collect and analyze aquatic insects as part of non-point source pollution studies and watershed assessment projects. ADEM monitoring programs integrate chemical criteria, whole effluent toxicity evaluations, and biological assessments to evaluate the water quality of Alabama's surface waters. Biological scoring criteria are utilized to evaluate the biotic integrity of each stream in relation to ecoregional reference sites (ADEM 2004).

According to ADEM (2004), Alabama's surface water is of generally high quality, but some rivers, streams, reservoirs, and estuaries are not supporting designated uses.

Alabama's Final 2004 §303(d) List indicates the total mileage for rivers and streams not supporting designated uses is 1,815.3 miles, or 2.3% of the state's 77,272 total river and



stream miles. Although these areas have not been mapped, Appendix 2-1 lists Alabama's designated waters and local watershed projects focused on determining and improving the condition of these important waters. Alabama's publicly accessible lakes and reservoirs have an 82.6% full support status. Listed sources for water quality impairment include agriculture, collection system failure, contaminated sediments, dam construction, flow regulation/modification, highway/road/bridge construction, industrial, intensive animal feeding operations, land development, landfills, mill tailings (abandoned), mine tailings (abandoned), municipal, natural sources, non-irrigated crop production, onsite wastewater systems, pasture grazing, removal of riparian vegetation, subsurface mining (abandoned), surface mining, surface mining (abandoned), unknown sources, and urban runoff/sewers. The majority of estuaries are affected by a single pollutant category, pathogens.

Alabama has initiated a Wetlands Identification Program in coastal Alabama (Baldwin County) and has completed an extensive study of the possible wetland restoration locations for five areas of the State (Alabama River Watershed, Lower Black Warrior River Watershed, Sipsey River Watershed, and Baldwin and Mobile counties). ADEM and the U.S. Army Corps of Engineers partner in the management and mitigation of impacts to wetlands in the water quality certification processes of Section 401 and 404 of the Clean Water Act.

Threats to Alabama's marine and estuarine habitat include oil and gas pipelines and their landfall, shellfish contaminants and wetland loss. Historically the most significant impact to Alabama's estuaries has been the indirect and direct impacts of dredged material disposal. Global warming may also dramatically alter Alabama's marine communities as waters warm but the coastline and associated freshwater inputs block the migration of fisheries attempting to expand their ranges northward (GMFMC 1998).

## Chapter 4. Conservation Actions Proposed for GCN Species and Habitats

Once Alabama's GCN species (Element 1, Chapter 1), key habitats (Element 2, Chapter 2), and threats to both (Element 3, Chapter 3) had been determined, then the priority research and survey needs and conservation actions could be assessed. This chapter describes the methods used to identify these priority needs, the status and condition of each key habitat (Element 2), the priority needs of each habitat (Elements 3 and 4), key conservation areas, partnerships for implementation (Element 7), and sources of additional information.

### ***Identifying and Prioritizing Conservation Actions***

This CWCS process used the 2002 Nongame Conference recommendations as a foundation for identifying needed conservation actions, refining, updating and expanding them with the input of multiple partners and stakeholders (Element 4). Many of the actions listed in this chapter are the result of the specific scientific consensus on GCN species and have been refined and prioritized from *Alabama Wildlife*, Volumes 2 and 3 (Mirarchi et al. 2004a, b) as well as the more general and policy based actions from Volume 4 (Mirarchi et al. 2004c).

All conservation actions were compiled from recommendations in the Nongame Conference and numerous existing recovery and conservation plans. Of these hundreds of recommendations, only those recurrent high and highest priority actions are presented in this CWCS to be accomplished in the next ten years. Actual implementation will be largely dependent on external factors including availability of funding and resources as well as the development of effective relationships with local, state, regional, public and private stakeholders and partners. Those conservation actions that impacted the highest number of GCN species and/or their key habitat were considered "highest priority." These actions often covered suites of highest priority (i.e., P1, P2) species and multiple GCN taxa. Those conservation actions that impacted fewer GCN species and did not have as broad habitat implications were considered "high priority" actions. These actions often were directed to a single species or to a suite of lower priority species and were more specific in nature.

The Forever Wild Amendment (no. 543) of the Constitution of the State of Alabama calls for SLD-NHS to "develop a Natural Heritage Plan which suggests priorities for the protection, acquisition and management of dedicated natural area preserves." The Natural Heritage Plan is currently in preparation, and once completed, should be a useful tool to further guide conservation actions for GCN species and their habitats.

Conservation actions are organized in several ways to best address the needs of Alabama's wildlife and its conservation. It is clear that conservation occurs at multiple scales, from the most specific population and local level to the more broad, overarching taxa and statewide geographic scales. This chapter presents conservation actions across the spectrum of scales in order to capture the breadth of conservation needed in Alabama. First it presents the broadest, overarching, statewide actions, and then presents more specific taxa

or habitat focused actions for each of the 15 terrestrial and estuarine habitats and 15 river basins.

### ***Statewide Conservation Actions--All Habitats***

**S1.** DWFF should provide information on GCN species, their habitats and conservation needs to appropriate water and land use decision-makers. SWG funding and the CWCS process provide an unprecedented opportunity for DWFF to expand its leadership role in the dissemination of information about good land and water stewardship. Following completion of the CWCS, product development should be tailored to the wildlife conservation needs of water and land use decision-makers at local, regional and statewide scales. This will allow GCN species, habitats, and their conservation actions from this CWCS to be incorporated and integrated into their conservation plans to promote a coordinated Alabama conservation effort.

**S2.** DWFF should develop an effective data management system and network to provide for efficient data input and monitoring of information on GCN species, key habitats, threats, and conservation actions in order to fully implement and update this CWCS. Historically, DWFF has lacked the resources to institute and maintain a comprehensive data management system. A partnership with SLD-NHS has been formed to address this deficiency and allow for timely updating of the CWCS and dissemination of information. DWFF should develop data sharing agreements among the various agencies and organizations which maintain data on GCN species.

**S3.** ADCNR and other land management agencies should use a landscape management approach to enhance GCN species and their habitats. Decisions on how to manage public lands should be made in the broadest possible context, rather than based on timber stands. Biological monitoring should be developed to address the ecological and landscape context of populations.

**S4.** DWFF should produce a formal revision of this CWCS (an action plan for all GCN species and their key habitats) every ten years. This strategy outlines specific actions needed to monitor and conserve GCN species and their key habitats as well as threats to each and actions to address these threats. Since it is a dynamic document designed to adaptively manage Alabama's wildlife and habitats, an effective monitoring framework needs to be developed to monitor and track the status, condition, and effectiveness of these conservation needs and actions. Revisions of the CWCS should also include a review and summary of conservation successes during the preceding ten years.

**S5.** DWFF should include as many imperiled animal taxa in updates and revisions of this CWCS as possible. This CWCS limits wildlife species coverage to particular taxa groups, commensurate with current knowledge and available funding. To be able to work fully and cooperatively with the federal government to achieve complete recovery of imperiled taxa, ADCNR should seek comprehensive information and additional funding for taxa not included in this CWCS. Wildlife restoration activities should be fully integrated with the management of imperiled plants.

**S6.** DWFF should enhance wildlife protection regulations to address all GCN wildlife species. Some GCN species are currently not protected by state statute. Coverage should be expanded to include all GCN species. DWFF should also work closely with other regulatory agencies to insure that the destruction of key habitats for GCN species is minimized.

**S7.** DWFF should review and update the permitting process for collection of wildlife species in Alabama to insure adequate conservation of GCN species. The system used to distribute commercial and scientific collection permits should be reviewed and updated to provide adequate protection of GCN species, including reporting and enforcement measures. Collection information from permittees should be incorporated into a comprehensive data management system.

**S8.** DWFF SWG Steering and Technical Committees should review and provide recommendations to prioritize research studies and management actions for GCN species and their habitats. These committees have had overall responsibility for development of the CWCS and identification of SWG funding priorities. Continued involvement of these committees is essential to insure continuity of CWCS implementation over the next 10 years.

**S9.** ADCNR Divisions should coordinate wildlife management to most effectively conserve GCN species and their habitats on lands under their jurisdiction. ADCNR lands should be managed to benefit GCN species and their habitats and to provide demonstration areas of proper land stewardship for other public and private landowners. State owned lands should be managed to minimize unnecessary, artificial, and/or unnatural structures and processes. Infrastructure improvements for public access should be built away from environmentally sensitive areas.

**S10.** DWFF should expand its education and outreach programs regarding the importance and sensitivity of GCN species and all wildlife species found in the state. Private landowners should be targeted to provide facts, build trust to increase the use of conservation easements and other habitat conservation programs that may be necessary to protect imperiled taxa and property rights in the future.

This CWCS, building upon the foundation of the 2002 Nongame Conference, associates GCN species with 15 river basins and 15 terrestrial and estuarine habitats. Specific recommendations to improve these important systems in Alabama and the imperiled GCN invertebrate and vertebrate species have been compiled from a number of sources (Mirarchi 2004, Mettee *et al.* 1996, Kingsbury and Gibson 2002, Bailey *et al.* 2005, Boschung and Mayden 2004) as well as numerous species recovery plans and watershed management plans.

### ***Statewide Conservation Actions -- Terrestrial and Estuarine Habitats***

Presented below are overarching conservation actions to benefit the wildlife of Alabama's terrestrial and estuarine habitats. Those listed below can be applied to multiple habitats occurring statewide. More specific management needs and conservation actions for

GCN species are subsequently presented by habitat type. Conservation actions that are specific to certain habitats (e.g., bogs, caves, dunes, glades) are presented in the respective habitat sections appearing later in this chapter.

**S11.** Acquire better spatial data on all habitats through remote sensing and ground truthing, and identify any extensive (at least 400-hectare; 1,000-acre) forested natural communities and contact landowners to seek protection of the system through outright willing seller purchase and/or conservation easements. Once such tracts are located, try to obtain additional adjacent acreage as it becomes available through purchase and/or easement; the larger the tracts the better. Purchase of large tracts of land currently containing longleaf stands, or those that previously held longleaf stands, should be high priority targets. When purchasing tracts such as those described above, assign high priority to those located adjacent to, or close by, currently intact tracts held by federal, state, and private organizations/agencies. This action will address the threat of habitat loss, fragmentation and degradation of the state's forest habitats resulting from development, conversion to pulpwood plantations and/or agriculture.

**S12.** Where present, maintain native community structure and composition. A key to maintaining the proper plant and animal community structure may involve proper identification, maintenance, and/or restoration of the natural fire frequency, intensity, and seasonality.

**S13.** Where absent, restore native community structure and composition. Non-native, or off-site tree species that would not naturally occur on a site should be removed over time. This can be accomplished through various silvicultural options that allow timber harvests that promote open canopies. The threat of loss of natural community integrity will be minimized by maintaining or restoring fire to appropriate communities.

**S14.** Allow dead trees and woody debris to decompose naturally on the ground. Many reptiles, amphibians, and small mammals nest, forage, or seek shelter in or underneath rotten logs. The threats of lost natural community integrity and exotic and/or non-native species will be minimized by removing the latter from appropriate communities.

**S15.** If logging is conducted, minimize soil disturbances from thinning and harvesting activities by conducting harvests during drier seasons and/or through use of low-tire-pressure equipment. Heavy equipment can compact/disturb soil, increase erosion/sediment, provide corridors for invasive plant species along trails, and elevate vehicle-related mortality rates among low mobility wildlife species. Minimizing habitat disturbance by using appropriate timing and equipment will alleviate this threat to fish and wildlife.

**S16.** Exclude logging, grazing, development, mechanized vehicle trails, and other erosion-generating activities uphill from biologically significant sites. Sediment from uphill can wash down, filling cracks and crevices that vertebrate species rely on for critical microhabitat needs. This will minimize the threats of non-point source pollution and habitat disturbance to these microhabitats. Following forestry BMPs should avoid this.

**S17.** For critical and unique habitats embedded in a forest matrix, identify, retain, and avoid disturbances (e.g., roads, firebreaks, trails) near such embedded habitats. Many forest-related wildlife taxa require embedded, sensitive habitats for part of their life history and/or seasonal migration patterns and vice versa. Both the embedded habitat and the surrounding forest matrix must be present for them to survive. Where necessary, restore natural hydrology in embedded wetlands by filling ditches and removing berms and other drainage structures that have altered the natural hydrology of the area. These actions will prevent or restore the loss of natural community integrity.

**S18.** Maintain or, where feasible, restore contiguous gradients (ecotones) into adjacent habitats such as floodplain forests. High-intensity roads, development, agriculture, and intensive silvicultural activities that are placed between complementary habitats may alter seasonal movements and make natural dispersal patterns difficult or even impossible for species of low mobility, such as amphibians and reptiles and some small mammals. This action addresses the threat of loss of natural community integrity.

**S19.** Exclude, and when necessary and feasible, remove exotic plant and animal species. If, and where, herbicides are necessary to remove exotic plants, use spot applications instead of widespread aerial applications. Widespread herbicide applications can disrupt food chains that may have long-term effects on various wildlife species. Similarly, using techniques that specifically target exotic wildlife species, such as feral hogs, is recommended over techniques that may also impact native species. The threat of impacts of exotic species will be reduced by such exclusion and/or removal and will minimize the threat of improper use of herbicides.

**S20.** If necessary to establish wildlife openings or other enhancements for wildlife species within natural forest stands, use sites of previous disturbance or choose new sites that mimic natural disturbances to avoid unwanted impacts. Wildlife openings should be kept small and should be sized and located to mimic natural disturbances. While log landings may provide promising sites for such openings, they often are not ideal because they usually are close to roads and have soil compaction problems. Also, avoid introduction of plant species that can escape from the immediate area and into surrounding woodlands (e.g., bicolor lespedeza). These actions will minimize the threats of new habitat disturbance and spread of invasive species in Alabama's natural forests.

**S21.** Minimize construction of access roads and all-terrain-vehicle trails to those absolutely necessary to conduct maintenance activities and to provide minimal access to the public; where possible, gate existing roads, particularly during critical times of the year, (e.g., breeding seasons). Excessive numbers of roads, trails, and motorized vehicles compact/disturb soil, increase erosion/sediment, provide corridors for invasive plant species along trails, increase the potential for illegal activities, and may disrupt normal wildlife behavior. Minimizing their number and usage addresses the threat of habitat disturbance.

**S22.** Minimize publicity about biologically significant areas to prevent collecting, poaching, or indiscriminate killing. Hibernating bats and snakes, nesting shorebirds, dense populations of salamanders, and other wildlife concentrations are extremely vulnerable to harvest or

killing. This action will increase conservation-related education and outreach about biologically significant areas and species, reducing the threat of direct exploitation.

**S23.** Direct foot traffic (trails) away from sensitive habitat features such as seeps, ravines, coves, etc. Soil disturbances, recreational killing, and noise-related disruptions of natural behaviors are unfortunate side effects of recreational access. Impacts resulting from such disturbances can thus be avoided and minimized.

### ***Conservation Actions for Specific Terrestrial and Estuarine Habitats***

Presented below are overviews of Alabama's 15 Terrestrial and Estuarine habitats (Element 2), including lists of GCN species (Element 1), their primary research and monitoring needs (Element 3), priority conservation actions to benefit GCN species and their habitats (Element 4), and additional sources of information. These non-riverine habitats are listed based on number of GCN species. Most species are terrestrial, but pond-breeding amphibians, some cave dwellers, and estuarine species are included.

Maps of terrestrial habitats were prepared for this CWCS by Alabama's GAP Analysis Program, and represent the best data available at this time. In each map, urbanized areas are indicated in red and the featured habitat is shaded green. Some terrestrial habitats do not lend themselves to remote sensing and are therefore not mapped. Obtaining more accurate spatial data for all habitat types is recognized as an important conservation need.

## Dry Hardwood Forest



DeKalb County

Mark Bailey



### Description and Location

Under natural conditions, this was the “oak-hickory” forest covering much of Alabama’s Piedmont, Ridge and Valley, Southwestern Appalachians, and Interior Plateau, and also in fire-sheltered terrain of the Southeastern Plains where pine forests otherwise predominated. Occurring primarily on upland ridges and upper to mid slopes on a variety of soils, this habitat is highly variable in tree species composition and is dominated by combinations of oaks (*Quercus* spp.), sometimes with pines (*Pinus* spp.) as a significant component. Many of these dominant tree species live for several centuries, and the original forest was old growth with regeneration primarily occurring in canopy gaps created by wind and fire.

In habitats regenerating from clearcut silviculture or cultivation, pines dominate at first, with oaks and hickories (*Carya* spp.) gradually invading the understory and establishing longer-term dominance.

A well-developed understory and shrub layer is generally present. The herbaceous layer is often sparse, but before natural fires were suppressed, these forests are thought to have had less of an understory and shrub component and probably more of a grassy herbaceous layer.

*Encompasses six NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southern Piedmont Dry Oak-(Pine) Forest				X		
Allegheny-Cumberland Dry Oak Forest and Woodland	X	X	X			
Southern Ridge and Valley Dry Calcareous Forest		X	X	X		
Southern Interior Low Plateau Dry Oak Forest	X					
East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest					X	
East Gulf Coastal Plain / Central Florida Upland Hardwood Forest					X	



**TABLE 4-1. GCN SPECIES, DRY HARDWOOD FOREST**

<b>28 GCN SPECIES</b> include 2 amphibians, 8 reptiles, 6 birds, and 12 mammals. Thirty-six additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (2)</b>		Bachman's Sparrow	P2
Gopher Frog	P1	American Kestrel	P2
Green Salamander	P2	Wood Thrush	P2
<b>REPTILES (8)</b>		<b>MAMMALS (12)</b>	
Southern Hognose Snake	P1	Rafinesque's Big-eared Bat	P1
Eastern Diamondback Rattlesnake	P2	Indiana Bat	P1
Southeastern Five-lined Skink	P2	American Black Bear	P1
Prairie Kingsnake	P2	Southeastern Pocket Gopher	P2
Eastern Kingsnake	P2	Northern Yellow Bat	P2
Speckled Kingsnake	P2	Long-tailed Weasel	P2
Eastern Coral Snake	P2	Southeastern Myotis	P2
Northern Pine Snake	P2	Little Brown Bat	P2
<b>BIRDS (6)</b>		Northern Myotis	P2
Cerulean Warbler	P1	Pygmy Shrew	P2
Red-cockaded Woodpecker	P1	Eastern Spotted Skunk	P2
Bewick's Wren	P1	Appalachian Cottontail	P2
P1: Priority 1 – Highest Conservation Concern   P2: Priority 2 – High Conservation Concern			

Representative high-quality sites include Talladega National Forest (Clay, Cleburne counties), Skyline WMA (Jackson County), Walls of Jericho (Jackson County), Little River Canyon National Preserve (DeKalb and Cherokee counties).

### Condition

A significant portion of this habitat in Alabama is currently composed of successional forests as the result of repeated cutting, clearing, and cultivation of the original oak-hickory forests. The distribution of this habitat has increased in recent decades as small farms have reverted to forest. Although fires have been suppressed for decades, low-intensity surface fires were historically an important natural factor in species composition, and may have been important in favoring oaks and pines over other canopy trees. Large areas once dominated by oak-hickory forests now have successional pine forest due to previous cutting as well as conversion to agriculture. Most of the canopy species are only moderately tolerant of shade, but more shade-tolerant species appear to be increasing in many of these forests, particularly red maple. This may be a result of loss of regular fire, which creates gaps in the system. Before the chestnut blight a century ago, American chestnut was the dominant tree in many places, but it is absent as a canopy species today.

### Problems Affecting Species/Habitat

- Loss of higher quality habitats from commercial and residential development, conversion to agriculture and/or intensive silviculture, and/or incompatible land uses (e.g., mining) [CA1, CA2, CA6]

- Reduction of habitat suitability due to urban development and fragmentation [CA1]
- Invasive exotic plants (autumn olive, Japanese honeysuckle, kudzu) and animals (fire ants, feral cats, etc.) [CA4]
- Scarcity of mature forest characteristics (cavities, snags, hollows) due to harvest rotations [CA2, CA5, CA6]
- Change in vegetative structure and species composition due to absence of the natural fire regime [CA3, CA7, CA8, CA9]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R7]
- Impacts from excessive soil disturbances from site preparation activities [CA7]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA7]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Southern Hognose Snake** – Possibly extirpated. Intensive surveys (in this habitat as well as Dry Longleaf Pine Forest) are needed to determine whether this species still occurs in Alabama. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Pygmy Shrew** – First discovered in extreme northeast Alabama in the 1990s. This is a particularly high priority species for distributional surveys, monitoring, and evaluation of habitat requirements. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; identification of limiting factors, habitat requirements and/or threats for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Bewick's Wren** – Investigate/determine cause(s) of precipitous regional decline. *Product(s)*: Identification of limiting factors, habitat requirements and/or threats for GCN species population.
- R4. **Indiana Bat** – identify summer maternity areas/habitats (mature trees with exfoliating bark). *Product(s)*: Data to complete or expand GIS coverages for this GCN species.
- R5. **Wood Thrush, Cerulean Warbler** – Monitor reproductive success to determine limiting factors for populations. *Product(s)*: Identification of limiting factors, habitat requirements and/or threats for GCN species population.
- R6. Bird nesting productivity studies are needed including Cowbird parasitism studies. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions regarding protection of Alabama's birds and their habitats.
- R7. Better maps of the distribution of dry oak forest communities are needed. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

**Highest Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect and promote large, unfragmented tracts by protecting existing significant tracts. Work with **Forest Legacy, Land Trusts, TNC** and other partners to acquire or purchase conservation easements to protect significant blocks (>1,000 acre parcels) of high quality examples of this habitat. Work with **NRCS, USFWS, USFS, AFC**, and other granting agencies or institutions to provide incentives and information to landowners for long-term conservation. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA2. Avoid/discourage conversion to other forest types (**USFS, AFC, AFA**). *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Promote low-intensity controlled burns where ecological, safety, and property protection considerations allow (**AFC, AFA**, and public/private landowners). *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA4. Control exotic plant and animal species (**NRCS, USFS, AFC**). *Performance measures:* Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA5. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS, PIF USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

**High Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA6. Encourage, through educational outreach and tax incentives or credits, managers and landowners to favor mature and old-growth hardwood stands (because these are most often in shortest supply on a landscape scale). *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA7. Avoid or minimize plowed fire lines when possible; place fire lines where disturbance to sensitive natural groundcover can be avoided or minimized. Restore topography and natural vegetation where emergency plowed fire lines disrupt natural areas. Work with **AFC, USFS**. *Performance measures:* Identification and

mapping of sensitive habitats that should be avoided; acres restored, enhanced, and/or protected by fee-simple or easements.

- CA8. Investigate effects of season and intensity of prescribed fire as a management technique (**AFC**). *Performance measure:* Research project(s) that determine effects of prescribed fire on this key habitat.
- CA9. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.

### Priority Areas for Conservation Action

- Bald Rock Mountain
- Bankhead/Warrior Mountains
- Bear Creek Ravines
- Bibb County Glades
- Black Warrior River Bluffs
- Cane Creek/Little Mountain
- Chandler Mountain
- Cheaha Mountain
- Chitwood Barrens
- Coon Gulf
- Coosa Valley Prairies
- Cunningham Creek Hills
- Dugger/Talladega Mountains
- Fort Benning
- Fox Mountain
- Franklin/Marion/Jackson Mountains
- Freedom Hills and Adjacent Lands
- Ft. Tombecke – Jones Bluff
- Huntsville Mountains
- Indian Mountain
- Inland Lake/Blackburn Fork Woods
- Jones Bluff
- Little River Canyon
- Lookout and Pigeon Mountains
- Lower Alabama River Bluffs and Swamps
- Lower Hatchet Creek/Coosa WMA
- Moss Rock
- Noxubee Prairies and Forests
- Oak and Double Oak Mountains
- Oakmulgee District, Talladega National Forest
- Old Bluffport
- Old Cahawba Prairies
- Osborne Hill Barrens
- Oseligee Creek
- Pelham Range Prairie
- Pike County Pocosin Sandhills
- Prairie Grove Glades
- Rock Creek Barrens
- Sandy Creek
- Skirum Bluff
- Skyball Mountain
- Spring Valley
- Srygley Barrens
- Sunny Home Glades
- Talladega Mountains
- Tensaw Delta
- Thorne Glade
- Tilden Carlowville Prairie Complex
- Tom Cat Prairie
- Transition Hills
- Upper Cahaba Watershed
- Upper Gurley Creek
- Weisner Mountain
- Wheeler NWR / Redstone Arsenal

## Mesic Hardwood Forest



Ravine slope, Monroe County

Mark Bailey



### Description and Location

These mixed deciduous hardwood or occasionally hardwood-pine forests, with canopy closure typically exceeding 40 percent, occur on a variety of mesic sites virtually statewide. Most examples occur in somewhat protected landscape positions such as coves and lower slopes or north-facing slopes where topography creates mesic moisture conditions. Others occur on slopes and ravines between dry uplands and stream bottoms. Fire is naturally infrequent, due to the slopes and moist conditions. American beech is often the most prominent of a mix of mesophytic tree species. This is distinguished from the Floodplain Forest habitat type by the absence of characteristic alluvial or bottomland species, along with its more upland position. In some mesic forests the herb layer is very rich, with abundant spring ephemeral wildflowers.

Mesic forests generally exist naturally as old-growth, with canopy dynamics dominated by gap phase regeneration. Small canopy gaps created by wind are likely the primary form of natural disturbance. Most of the prevailing species are shade tolerant, but not very fire-tolerant.

*Encompasses six NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southern Piedmont Mesic Forest				X		
South-Central Interior Mesophytic Forest	X	X	X			
East Gulf Coastal Plain Southern Mesic Slope Forest					X	
East Gulf Coastal Plain Northern Mesic Hardwood Forest					X	
East Gulf Coastal Plain Limestone Forest					X	
East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods						X



**TABLE 4-2. GCN SPECIES, MESIC HARDWOOD FOREST**

**32 GCN SPECIES** include 3 amphibians, 6 reptiles, 12 birds, and 11 mammals. Forty-seven additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).

<b>AMPHIBIANS (3)</b>		American Kestr	P2
Green Salamander	P2	Southeastern American Kestrel	P2
Seepage Salamander	P2	Worm-eating Warbler	P2
Red Hills Salamander	P2	Swainson's Warbler	P2
		Kentucky Warbler	P2
<b>REPTILES (6)</b>		Wood Thrush	P2
Prairie Kingsnake	P2	American Woodcock	P2
Eastern Kingsnake	P2		
Speckled Kingsnake	P2	<b>MAMMALS (11)</b>	
Eastern Coral Snake	P2	American Black Bear	P1
Coal Skink	P2	Rafinesque's Big-eared Bat	P1
Southeastern Five-lined Skink	P2	Indiana Bat	P1
		Northern Yellow Bat	P2
<b>BIRDS (12)</b>		Southeastern Myotis	P2
Cerulean Warbler	P1	Little Brown Bat	P2
Bewick's Wren	P1	Northern Myotis	P2
Short-eared Owl	P2	Pygmy Shrew	P2
Northern Harrier	P2	Long-tailed Weasel	P2
Swallow-tailed Kite	P2	Eastern Spotted Skunk	P2
		Appalachian Cottontail	P2

P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.

Two GCN salamanders are found only in this habitat type. The Seepage Salamander occurs in the Piedmont as well as the Fall Line Hills of the Southeastern Plains (it is included under Bogs and Associated Communities as well, but the seeps it inhabits are typically embedded in mesic forest). The Red Hills Salamander is endemic to mesic forest in the Buhrstone/Lime Hills of the Southeastern Plains.

Representative high-quality sites include Bankhead National Forest, Skyline NWR, Walls of Jericho, Haines Island Park (Monroe County), Jones Bluff Park (Autauga County).

### Condition

Much of this habitat in Alabama is currently highly fragmented and composed of young successional forests as the result of repeated cutting. Large areas have been converted to loblolly pine plantations, especially in the Southeastern Plains.

**Problems Affecting Species/Habitat**

- Loss of higher quality habitats from conversion to other forest types [CA1, CA2, CA4]
- Reduction of habitat suitability due to urban development and fragmentation [CA1, CA4]
- Invasive exotic plants (kudzu, privet, Japanese honeysuckle, etc.) [CA3]
- Scarcity of mature forest characteristics (cavities, snags, hollows) due to harvest rotations [CA5]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species [R1 – R7]

**Priority Research/Survey/Monitoring Needs**

*For detailed information on GCN species and their conservation actions please see **Alabama Wildlife** Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Pygmy Shrew** – First discovered in extreme northeast Alabama in the 1990s. This is a high priority species for distributional surveys, monitoring, and determination of habitat requirements. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; identification of limiting factors, habitat requirements and/or threats for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Indiana Bat** – identify summer maternity areas/habitats (mature trees with exfoliating bark). *Product(s)*: Data to complete or expand GIS coverages for this GCN species.
- R3. **Wood Thrush, Cerulean Warbler, Worm-eating Warbler, Swainson's Warbler, Kentucky Warbler** – Monitor reproductive success to determine limiting factors for populations. *Product(s)*: Identification of limiting factors, habitat requirements and/or threats for GCN species population.
- R4. Bird nesting productivity studies are needed including Cowbird parasitism studies. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions regarding protection of Alabama's birds and their habitats.
- R5. **Seepage Salamander** – Locate and map seepage habitats where this species occurs. Unless these are identified and excluded/protected from timber harvest, the species will continue to decline. Monitor known populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R6. **Red Hills Salamander** – Assess rangewide population status every five years. Coordinate with forest products companies who are reporting status to USFWS as part of their Habitat Conservation Plan requirement. *Products*: Updated population status every five years; inclusion of Habitat Conservation Plan monitoring data in the Natural Heritage Database and/or other ADCNR databases/coverages.
- R7. Better maps of the distribution of mesic forest communities are needed. A full inventory, classification, and mapping of Alabama's mesic forest habitats should be undertaken as a high priority. Forest Inventory data, consultation with forestry



and plant community authorities, and remote imagery should be used. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect and promote large, unfragmented tracts by protecting existing significant tracts. Work with **Forest Legacy**, **Land Trusts**, **TNC** and other partners to acquire or purchase conservation easements to protect significant blocks (>1,000 acre parcels) of high quality examples of this habitat. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Avoid/discourage conversion to other forest types (**USFS**, **AFC**, **AFA**). *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Control exotic species (**NRCS**, **USFS**, **AFC**). *Performance measures*: Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA4. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with USFS, PIF USFWS, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA5. Encourage managers to favor mature and old-growth hardwood stands (because these are most often in shortest supply on a landscape scale). *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

### Priority Areas for Conservation Action

- |                                           |                              |
|-------------------------------------------|------------------------------|
| • Bald Knob                               | • Brindley Mountain          |
| • Bald Rock Mountain                      | • Bryant Mountain            |
| • Bankhead/Warrior Mountains              | • Buttahatchee River Slopes  |
| • Bear Creek Ravines                      | • Cane Creek/Little Mountain |
| • Beaver Creek and School Creek Mountains | • Chandler Mountain          |
| • Bibb County Glades                      | • Cheaha Mountain            |
| • Big Ridge                               | • Columbiana Mountain        |
| • Black Warrior River Bluffs              | • Conecuh National Forest    |
| • Bogan Mountain                          | • Coon Gulf                  |
|                                           | • Cunningham Creek Hills     |

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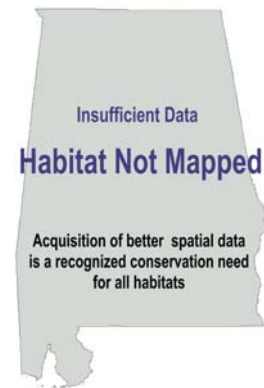
- Dugger/Talladega Mountains
- East Alabama Fall Line Hills
- Elk River Bluffs
- Fletcher's Hollow
- Fort Benning
- Fox Mountain
- Foxtrap Creek
- Franklin/Marion/Jackson Mountains
- Freedom Hills and Adjacent Lands
- Greens Creek Mountain
- Huntsville Mountains
- Indian Mountain
- Inland Lake/Blackburn Fork Woods
- Jones Bluff
- Little River Canyon
- Little Uchee Creek Ravines
- Lookout and Pigeon Mountains
- Lower Alabama River Bluffs and Swamps
- Lower Cahaba Bluffs and Swamps
- Lower Choctawhatchee River Bluffs
- Lower Hatchet Creek/Coosa WMA
- Moss Rock
- Natural Bridge
- Newsome Sinks
- Nickajack Cove
- North Fork Creek Glade
- Noxubee Prairies and Forests
- Oak and Double Oak Mountains
- Oakmulgee District, Talladega National Forest
- Old Bluffport
- Old Cahawba Prairies
- Oseligee Creek
- Patsaliga Creek
- Persimmon Creek
- Pike County Pocosin Sandhills
- Sandy Creek
- Sepulga River Slopes
- Shades Mountain
- Skyball Mountain
- Talladega Mountains
- Tallahatta Bluffs
- Tensaw Delta
- Transition Hills
- Turk's Cave
- Upper Cahaba Watershed
- Upper Gurley Creek
- Weisner Mountain
- Wheeler NWR / Redstone Arsenal

## Wet Pine Savanna and Flatwoods



Savanna near Coden, Mobile County

George Folkerts



### Description and Location

These open pine woodlands occupy sandy flatlands principally in the Gulf Coast Flatwoods of the Southeastern Plains. Pine flatwoods also may be found in portions of the Southern Pine Plains and Hills and the Dougherty Plain subdivisions, where they may be a component of a landscape matrix of several other habitats including xeric pine and floodplain forest. Even though this habitat is subject to seasonally high water tables, fire frequency is high. Overstory vegetation is characterized by longleaf pine and to a lesser degree by slash pine. The understory ranges from dense shrubs to open and herbaceous-dominated, and is heavily influenced by fire history. This habitat shares many wildlife species with dry longleaf pine forest, but the flatwoods salamander is found only in this habitat.

Representative high-quality sites include Grand Bay (Mobile County), Splinter Hill Bog (Baldwin County) and Conecuh National Forest (Escambia and Covington counties).

*Encompasses two NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
East Gulf Coastal Plain Near-Coast Pine Flatwoods					X	X
East Gulf Coastal Plain Treeless Savanna and Wet Prairie						X

### Condition

Much of this habitat has been lost to ditching (draining), development, agriculture, conversion to pine plantations, and fire suppression. This habitat is a component of a broader longleaf pine forest and savanna ecosystem, considered one of the most endangered ecosystems in the country today (Noss and Peters 1995). On some frequently burned federal lands (especially National Forests), the habitat is in good condition. Habitat is in fair to poor condition on other public land and most private and industry lands. Without the appropriate fire regime, canopy closure will increase along with shrub dominance, and grasses, forbs, and other finer-fuel components will

decline, further altering the fire regime dynamics. Prescribed growing-season fire needs to increase dramatically in this habitat type.

**TABLE 4-3. GCN SPECIES, WET PINE SAVANNA AND FLATWOODS**

<b>29 GCN SPECIES</b> include 3 amphibians, 10 reptiles, 10 birds, and 6 mammals. Forty-one additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (3)</b>		<b>BIRDS (10)</b>	
Flatwoods Salamander	P1	Henslow's Sparrow	P1
GopherFrog	P1	Red-cockaded Woodpecker	P1
Dusky Gopher Frog	P1	Bachman's Sparrow	P2
		Short-eared Owl	P2
		Northern Harrier	P2
<b>REPTILES (10)</b>		Yellow Rail	P2
Eastern Indigo Snake	P1	Swallow-tailed Kite	P2
Southern Hognose Snake	P1	American Kestrel	P2
Black Pine Snake	P1	Southeastern American Kestrel	P2
Eastern Diamondback Rattlesnake	P2	American Woodcock	P2
Coal Skink	P2		
Eastern Kingsnake	P2	<b>MAMMALS (6)</b>	
Speckled Kingsnake	P2	Southeastern Pocket Gopher	P2
Eastern Coral Snake	P2	Northern Yellow Bat	P2
Mimic Glass Lizard	P2	Long-tailed Weasel	P2
Florida Pine Snake	P2	Southeastern Myotis	P2
		Eastern Spotted Skunk	P2
		Marsh Rabbit	P2

P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.

Loss of quantity and quality of this habitat and the highly fragmented nature of remaining stands has resulted in the corresponding decline of a large number of terrestrial vertebrates that are found either primarily or exclusively in longleaf-dominated, fire-maintained habitats.

### Problems Affecting Species/Habitat

- Fire suppression and lack of fire [CA2, CA3, CA8]
- Altered hydrology due to drainage ditches, raised roadbeds, fire plow lines, etc. [CA2, CA7]
- Conversion to other pine species [CA2, CA3, CA6, CA9]
- Intensification of forestry practices (site preparation, heavy stocking densities) leading to closed canopy forests with little herbaceous groundcover [CA6, CA9]
- Urban development and habitat fragmentation [CA1, CA4, CA5, CA6]
- Lack of old growth characteristics (canopy gaps, red-heart fungus, cavities, snags) [CA1, CA2, CA6]
- Habitat loss affecting species that rely on understory management and open pine ecosystems [CA3, CA4, CA6]
- Exotic species (cogongrass; fire ants are occasionally present) [CA2, CA7]
- Pine straw raking impacting understory habitat [CA2]

- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R4]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA7]
- Insufficient conservation-related educational outreach about biologically sensitive areas and species [CA3, CA4, CA6]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Red-cockaded Woodpecker, Henslow's Sparrow, American Kestrel, Bachman's Sparrow** – Implement inventory and monitoring programs for these bird species on key public and private lands. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Flatwoods Salamander** – Possibly extirpated. Intensively survey to determine whether this species still occurs in Alabama. If rediscovered, natural history studies are needed to determine appropriate conservation strategies. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Mimic Glass Lizard** – Possibly extirpated. Intensively survey to determine whether this species still occurs in Alabama. If discovered, natural history studies are needed to determine appropriate conservation strategies. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. Develop better maps of the distribution of pine savanna and flatwoods communities. A full inventory, classification, and mapping of these habitats should be undertaken as a high priority. Forest Inventory data, consultation with forestry and plant community authorities, and remote imagery should be used. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts of unfragmented pine savanna and flatwoods. A high priority should be maintaining the largest and most threatened tracts in Mobile and Baldwin counties where development and sprawl is encroaching. Work with **Longleaf Alliance, USFWS, TNC** and other land conservation partners to identify, conserve and restore such tracts. Tracts containing isolated wetlands (i.e., ponds, bogs) and/or priority species should receive special priority for protection. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Restore existing savanna and flatwoods on state-owned lands through the filling of drainage ditches, establishment of native groundcovers, planting longleaf pine,

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growing old pines, and prescribed burning especially during the growing season. *Performance measures:* Acres restored and/or enhanced.

- CA3. Control midstory development and encourage understory development through prescribed burning. Acceptance of controlled burning can be enhanced through public education, programs to “fire-safe” properties, and cost-share programs to install fire lines and conduct controlled burns. *Performance measures:* Acres burned annually; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets); number of properties made “fire-safe” annually; and number of cost-share programs to install fire lines and conduct controlled burns.
- CA4. Coordinate and integrate existing initiatives and programs such as the **Northern Bobwhite Conservation Initiative** (NBCI) to influence habitat for birds and other wildlife by working with **ADCNR**, **USFWS**, and **NRCS**. *Performance measures:* Acres of habitat enrolled in NBCI and other programs; and number of joint projects with ADCNR, **USFWS** and **NRCS**.
- CA5. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS**, **PIF** **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA6. Publicize and encourage landowner participation in Alabama's statewide Red-cockaded Woodpecker Safe Harbor Plan by working with **USFWS**, **USFS**, **Longleaf Alliance** and **AFC**. *Performance measures:* Number of landowners participating in red-cockaded woodpecker Safe Harbor Plan; completion of an outreach plan; and outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA7. Avoid or minimize plowed fire lines when possible; place fire lines where disturbance to sensitive natural groundcover can be avoided or minimized. Restore topography and natural vegetation where emergency plowed fire lines disrupt natural areas. Work with **AFC**, **USFS**. *Performance measures:* Acres restored and/or enhanced; and identification and mapping of sensitive habitats that should be avoided.
- CA8. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.
- CA9. Encourage thinning of overstocked pine forests by working with **AFC**. *Performance measures:* Acres restored or enhanced by thinning of overstocked pines.

### Priority Areas for Conservation Action

- |                           |                        |
|---------------------------|------------------------|
| • Conecuh National Forest | • MS-AL Stateline Bogs |
| • Grand Bay Savanna       | • Splinter Hill Bog    |
| • Gulf Islands            | • Tensaw Delta         |



## Floodplain Forest



Floodplain Forest, Lowndes County

George Folkerts



### Description and Location

This diverse, statewide habitat category includes a range of situations where periodic flooding and flood-related environmental factors (wetness, scouring, deposition of material, and input of nutrients) affect vegetational composition and dynamics. Scour-influenced systems occur on high-gradient streams in gorges of the Southwestern Appalachians and Ridge and Valley, where shrubs, perennial grasses, and forbs dominate. Elsewhere, forests of larger floodplains and bottomlands often include depositional landforms such as levees, sloughs, ridges, terraces, and abandoned channel segments. Floodplain forests above the Fall Line are generally quite distinct from those of the Southeastern Plains, because of steeper river gradients and harder rocks. Baldcypress and tupelo gum are common components below the Fall Line, but not above. Vegetation along the larger streams and rivers generally includes forests dominated by bottomland hardwood species and other trees tolerant of flooding.

Representative high-quality sites include Mobile-Tensaw river delta (Mobile and Baldwin counties), Sipsey River Tract (Tuscaloosa County), Wheeler NWR (Morgan County).

*Encompasses eight NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Cumberland Riverscour	X	X	X	X		
Southern Piedmont Small Floodplain and Riparian Forest				X		
Southern Piedmont Large Floodplain Forest				X		
South-Central Interior Large Floodplain	X	X	X			
South-Central Interior Small Stream and Riparian	X	X	X			
East Gulf Coastal Plain Large River Floodplain Forest					X	
East Gulf Coastal Plain Blackwater River Floodplain Forest					X	X
East Gulf Coastal Plain Small Stream and River Floodplain Forest					X	



**TABLE 4-4. GCN SPECIES, FLOODPLAIN FOREST**

<b>30 GCN SPECIES</b> include 3 amphibians, 5 reptiles, 10 birds, and 12 mammals. Thirty-eight additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (3)</b>			
Southern Dusky Salamander	P1	Wood Stork	P2
River Frog	P1	American Black Duck	P2
One-toed Amphiuma	P2	American Woodcock	P2
<b>REPTILES (5)</b>		<b>MAMMALS (12)</b>	
Coal Skink	P2	American Black Bear	P1
Southeastern Five-lined Skink	P2	Rafinesque's Big-eared Bat	P1
Rainbow Snake	P2	Gray Myotis	P1
Eastern Kingsnake	P2	Indiana Bat	P1
Speckled Kingsnake	P2	Northern Yellow Bat	P2
<b>BIRDS (10)</b>		Southeastern Myotis	P2
Ivory-billed Woodpecker	EX	Little Brown Bat	P2
Cerulean Warbler	P1	Northern Myotis	P2
Swallow-tailed Kite	P2	Long-tailed Weasel	P2
Worm-eating Warbler	P2	Eastern Spotted Skunk	P2
Swainson's Warbler	P2	Pygmy Shrew	P2
Kentucky Warbler	P2	Marsh Rabbit	P2
Wood Thrush	P2		
Ex: Extirpated – No longer known to occur in Alabama			
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Condition

Much of this habitat has been lost to impoundments. Power generation and regulation of water flow create unnatural flood regimes, affecting large areas downstream from dams. Extensive erosion of uplands, caused by poor agricultural practices dating back to colonial times, transported large amounts of sediment into floodplains. Large floodplains often have substantial areas in cultivation. Many exotic plant species have invaded floodplains, perhaps more than in any other habitat type in Alabama.

### Problems Affecting Species/Habitat

- Loss and fragmentation of higher quality habitats from impoundment and conversion to agriculture and/or intensive silviculture [CA1, CA2, CA3, CA6, CA7]
- Change in vegetative structure and species composition due to alteration of the natural flood regime due to upstream dams, ditching, and draining [CA3, CA4]
- Invasive exotic plants (Chinese tallow tree, Japanese climbing fern, privet, Nepal grass, etc.) [CA5]
- Scarcity of mature forest characteristics (cavities, snags, hollows) due to harvest rotations
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R8]

- Insufficient conservation-related educational outreach about biologically sensitive areas [CA2, CA3, CA7]
- Loss of native community structure and composition due to fire suppression [CA8]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Ivory-billed Woodpecker** – In light of the species' recent (2004) rediscovery in Arkansas, it is possible that it occurs in remote portions of the Mobile-Tensaw delta or other large forested bottomlands and riverine swamps (i.e., Choctawhatchee/Pea, Tombigbee/Sipsey, Conecuh, etc.), and future reintroduction may be an option. Surveys for both the bird and suitable habitat should be conducted. *Product(s)*: Data to fill information gaps to map quality and distribution of potential habitat; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Indiana Bat** – identify summer maternity areas/habitats (mature trees with exfoliating bark). *Product(s)*: Data to complete or expand GIS coverages for this GCN species.
- R3. **Swallow-tailed Kite** – Systematic surveys should be conducted during breeding season (March-June) for nest locations and during post breeding dispersal (July-August) for communal roost locations in favorable habitats within the Southeastern Plains and Southern Coastal Plains ecoregions. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Swainson's Warbler** – Distributional surveys are needed in documented habitat types (e.g., canebrakes of bottomland forests, fragments of old growth bottomland forests, early seral stages of deciduous bottomland forests, and second-growth bottomland forest with scrub palmetto undergrowth). *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. **All GCN Warblers and Wood Thrush** – Monitor reproductive success to determine limiting factors for populations. *Product(s)*: *Identification* of limiting factors, habitat requirements and/or threats for GCN species population.
- R6. **Southern Dusky Salamander** – Intensive surveys of large river floodplains (Mobile, Tensaw, Conecuh, Yellow, Pea, Choctawhatchee, and Chattahoochee Rivers) and swampy creeks (in the Escatawpa, Mobile Bay, and Perdido drainage basins) near the Florida border should be made to define the species' explicit geographic distribution in Alabama. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R7. **One-toed Amphiuma** – A survey of likely river bottom habitats (Mobile, Tensaw, Perdido, Conecuh, Choctawhatchee, Chipola, and Chattahoochee Rivers) should be conducted. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R8. **River Frog** – A complete survey of distribution should be conducted including all historic localities and other sites with suitable habitat on both private and public lands. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts. Work with **NAWCA, Forest Legacy, Land Trusts, TNC** and other partners to protect significant blocks of high quality examples of this habitat. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Provide incentives and information to landowners for long-term conservation. Potential partners: **NRCS, USFWS** and other granting agencies or institutions. *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Avoid/discourage conversion to agriculture or other forest types, and encourage restoration of altered habitats. Potential partners: **NRCS, USFS, AFC, AFA**. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA4. Minimize, to the extent feasible, impacts of altered flood regimes. Potential partners: **TVA, U.S. Army Corps of Engineers, and Alabama Power Company**. *Performance measures*: Acres and/or stream miles restored or enhanced by use of natural flood regimes.
- CA5. Control exotic plant and animal species. Potential partners: Alabama Invasive Pest Plant Council (**ALIPPC**) **NRCS, USFS, AFC**. *Performance measures*: Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA6. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **USFS, PIF USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

#### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA7. Encourage managers and landowners to favor mature and old-growth stands. Potential partner: **AFC**. *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA8. Investigate effects of season and intensity of prescribed fire as a management technique. Potential partner: **AFC**. *Performance measure*: Research project(s) that determine effects of prescribed fire on this key habitat.

**Priority Areas for Conservation Action**

- Autauga Sandhills
- Ballplay Swamp
- Bankhead/Warrior Mountains
- Bibb County Glades
- Big Swamp Creek
- Buttahatchee River Slopes
- Cane Creek/Little Mountain
- Cedar Creek – Highway 41
- Chipola River/Big Creek Woods
- Conecuh National Forest
- Cunningham Creek Hills
- Dugger/Talladega Mountains
- East Alabama Fall Line Hills
- Fort Benning
- Foxtrap Creek
- Franklin/Marion/Jackson Mountains
- Grand Bay Savanna
- Green's Pitcher Plant Bog-Yellow Leaf Creek
- Little River Canyon
- Little Uchee Creek Ravines
- Lower Alabama River Bluffs and Swamps
- Lower Black Warrior Swamps
- Lower Cahaba Bluffs and Swamps
- Lower Choctawhatchee River Bluffs
- Lower Tombigbee River
- Mulberry Creek
- Noxubee Prairies and Forests
- Oakmulgee District, Talladega National Forest
- Prairie Bluff – Millers Ferry Prairie
- Sepulga River Slopes
- Sipsey River
- Splinter Hill Bog
- Spring Creek
- Talladega Mountains
- Tallahatta Bluffs
- Tapawingo Springs
- Tensaw Delta
- Tom Cat Prairie
- Transition Hills
- Wheeler NWR / Redstone Arsenal

## Dry Longleaf Pine Forest



Conecuh National Forest, Covington County

Mark Bailey



Note: Map indicates all pine types, not only longleaf.

### Description and Location

Longleaf pine forest was historically widespread in Alabama, occurring above the Fall Line in the Ridge and Valley and Piedmont and below the Fall Line in the Southeastern Plains. Longleaf pine habitats range from moist to very well drained sites, including mesic pine flatwoods, pine/scrub oak (*Quercus* spp.) sandhill, and xeric sandhill scrub. “Mountain” longleaf communities occur on rugged ridges north of the Fall Line, including some of Alabama’s highest elevations. Frequent fire maintains a canopy dominated by longleaf pine, with wiregrass (*Aristida beyrichiana*) or other grass/herb ground cover. When fire is infrequent, scrub oaks, other hardwoods, and shrubs become common in the midstory and shade out native grasses and forbs. Embedded within longleaf pine habitats are fire-dependent herbaceous bogs and isolated wetlands that contribute much of the biodiversity of the region. The top 10 counties in total natural and planted longleaf acreage include seven in the Southeastern Plains: Escambia (213,600 acres), Baldwin (172,000), Mobile (180,500), Covington (133,000), Washington (82,300), Monroe (22,400), and Houston (22,100) and three mostly or entirely above the Fall Line: Bibb (27,100) Shelby (24,200) and Talladega (22,700) (Hartsell and Brown 2002).

Representative high-quality sites include Conecuh National Forest (Covington, Escambia counties), Mountain Longleaf NWR (Cleburne County), Talladega National Forest (Clay, Cleburne, Bibb, Hale, Tuscaloosa counties).

*Encompasses two NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southeastern Interior Longleaf Pine Woodland			X	X		
East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland					X	

**TABLE 4-5. GCN SPECIES, DRY LONGLEAF PINE FOREST**

**31 GCN SPECIES** include 3 amphibians, 12 reptiles, 7 birds, and 9 mammals. Thirty-four additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).

**AMPHIBIANS (3)**

Flatwoods Salamander	P1
Gopher Frog	P1
Dusky Gopher Frog	P1

**REPTILES (12)**

Eastern Indigo Snake	P1
Southern Hognose Snake	P1
Black Pine Snake	P1
Eastern Kingsnake	P2
Speckled Kingsnake	P2
Eastern Coral Snake	P2
Northern Pine Snake	P2
Florida Pine Snake	P2
Eastern Diamondback Rattlesnake	P2
Gopher Tortoise	P2
Southeastern Five-lined Skink	P2
Mimic Glass Lizard	P2

**BIRDS (7)**

Red-cockaded Woodpecker	P1
Henslow's Sparrow	P1
American Kestrel	P2
Southeastern American Kestrel	P2
Wood Thrush	P2
Bachman's Sparrow	P2
American Woodcock	P2

**MAMMALS (9)**

American Black Bear	P1
Rafinesque's Big-eared Bat	P1
Indiana Bat	P1
Southeastern Pocket Gopher	P2
Long-tailed Weasel	P2
Eastern Spotted Skunk	P2
Southeastern Myotis	P2
Northern Myotis	P2
Little Brown Bat	P2

P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.

**Condition**

Longleaf pine was once Alabama's most abundant tree (Harper 1928), but it has been greatly reduced in its extent, with much of its range now occupied by agriculture and/or forestry operations. Longleaf pine communities now exist in just 3% of their previous range throughout the Southeast (Frost 1993). Longleaf pine forest and savanna is considered one of the most endangered habitats in the country today (Noss and Peters 1995). By 2000, only 732,800 acres of natural longleaf pine forest remained in 32 Alabama counties (Hartsell and Brown 2002). On some frequently burned federal lands (especially National Forests) and some private hunting preserves, the habitat is in good condition. Habitat is in fair to poor condition on other public land and most private and industry lands.

Without the appropriate fire regime, canopy closure will increase along with shrub dominance, and grasses, forbs, and other finer-fuel components will decline, further altering the fire regime dynamics. Prescribed growing-season fire needs to increase dramatically in these systems; midstory reduction is essential.

Loss of quantity and quality of longleaf pine forest and the highly fragmented nature of remaining tracts has resulted in the corresponding decline of a large number of terrestrial vertebrates that can be considered "longleaf specialists," found either primarily or exclusively in longleaf-dominated habitats. More P1 species occur in this habitat type than any other (Mirarchi 2004).



### Problems Affecting Species/Habitat

- Fire suppression and lack of fire [CA2, CA10]
- Intensification of forestry practices (site preparation, heavy stocking densities) leading to closed canopy forests with little herbaceous groundcover [CA2, CA3, CA11]
- Urban development and habitat fragmentation [CA1, CA2, CA5, CA7, CA8]
- Lack of old growth characteristics (canopy gaps, red-heart fungus, cavities, snags) [CA2]
- Habitat loss affecting species that rely on understory management and open pine ecosystems [CA1, CA2, CA3, CA4, CA6, CA11]
- Exotic species, especially fire ants [CA2, CA9]
- Pine straw raking impacting understory habitat [CA3]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species [R1 – R6]
- Insufficient conservation-related educational outreach about biologically sensitive areas [CA3, CA6, CA11]
- Impacts from excessive soil disturbances from site preparation activities (i.e., fire plow lines) [CA9]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA9]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see **Alabama Wildlife** Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Southern Hognose Snake** – Possibly extirpated. Intensive surveys (primarily in this habitat; also in Dry Oak Forest) are needed to determine whether this species still occurs in Alabama. Surveys for this species should also target the other upland GCN snakes of this habitat. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Southeastern Pocket Gopher, Gopher Tortoise** – Document commensal invertebrate and vertebrate burrow fauna in conjunction with range-wide surveys (which could be conducted concurrently) for these keystone burrowing animals. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN species and commensal fauna; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Red-cockaded Woodpecker, Henslow's Sparrow, American Kestrel, Bachman's Sparrow** – Implement inventory and monitoring programs for these bird species on key public and private lands. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Eastern Indigo Snake** – Experimental reintroduction sites (from the 1980s) should be intensively re-surveyed to determine success. *Product(s):* Data to fill information gaps to assess the status and/or condition of this GCN species and its reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.



- R5. **Dusky (Mississippi) Gopher Frog** – Possibly extirpated. Intensive surveys at potential breeding sites in Mobile and Washington counties are needed to determine whether this species still occurs in Alabama (see Small Isolated Wetlands). *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R6. Better maps of the distribution of longleaf pine communities are needed. A full inventory, classification, and mapping of Alabama's longleaf pine habitats should be undertaken as a high priority. Forest Inventory data, consultation with forestry and plant community authorities, and remote imagery should be used. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect and promote large, unfragmented tracts by protecting existing significant tracts. A high priority should be maintaining the largest and most threatened tracts in Mobile and Baldwin counties where development and sprawl is encroaching. Large holdings in Escambia and Washington counties are also at risk of conversion or degradation. Work with **Forest Legacy, Land Trusts, TNC** and other partners to identify, conserve and restore such tracts. Tracts containing isolated wetlands (i.e., ponds, bogs) and/or priority species should receive special priority for protection. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Restore existing longleaf on state-owned lands through the establishment of native groundcovers, planting longleaf pine, growing *old* pines, and prescribed burning especially during the growing season. *Performance measures*: Acres restored and/or enhanced.
- CA3. Control midstory development and encourage understory development through prescribed burning. Acceptance of controlled burning can be enhanced through public education, programs to “fire-safe” properties, and cost-share programs to install fire lines and conduct controlled burns. *Performance measures*: Acres burned annually; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets); number of properties made “fire-safe” annually; and number of cost-share programs to install fire lines and conduct controlled burns.
- CA4. Coordinate and integrate existing initiatives and programs such as the **Northern Bobwhite Conservation Initiative** (NBCI) to influence habitat for birds and other wildlife by working with **ADCNR, USFWS, and NRCS**. *Performance measures*: Acres of habitat enrolled in **NBCI** and other programs; and number of joint projects with ADCNR, **USFWS** and **NRCS**.
- CA5. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **USFS, PIF USFWS**, and others to

fund and/or implement conservation projects for mutually identified species, habitats or needs.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA6. Publicize and encourage landowner participation in Alabama's statewide Red-cockaded Woodpecker Safe Harbor Plan by working with **USFWS**, **USFS**, **Longleaf Alliance** and **AFC**. *Performance measures:* Number of active Red-cockaded Woodpecker clusters on private lands, number of landowners participating in Red-cockaded Woodpecker Safe Harbor Plan; completion of an outreach plan; and outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA7. Enhance/protect longleaf on the 2,000+ acres of mature longleaf on Lake Mitchell in Coosa and Chilton counties by working with **Alabama Power Company** and **Hancock Forestry Management**. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA8. Enhance/protect/restore the significant longleaf pine resource of **Fort Rucker**. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA9. Avoid or minimize plowed fire lines when possible; place fire lines where disturbance to sensitive natural groundcover can be avoided or minimized. Restore topography and natural vegetation where emergency plowed fire lines disrupt natural areas. Work with **AFC**, **USFS**. *Performance measures:* Identification and mapping of sensitive habitats that should be avoided; acres restored, enhanced, and/or protected by fee-simple or easements.
- CA10. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.
- CA11. Encourage thinning of overstocked pine forests by working with **AFC**. *Performance measures:* Acres restored or enhanced by thinning of overstocked pines.

### Priority Areas for Conservation Action

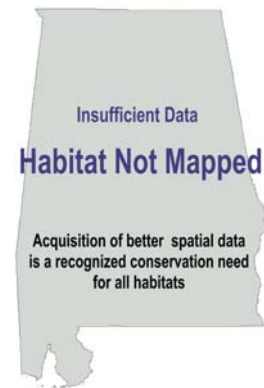
- Autauga Sandhills
- Bald Rock Mountain
- Bankhead/Warrior Mountains
- Bibb County Glades
- Conecuh National Forest
- Dugger/Talladega Mountains
- East Alabama Fall Line Hills
- Fort Benning
- Grand Bay Savanna
- Gulf Islands
- Lower Hatchet Creek/Coosa WMA
- Moss Rock
- MS-AL Stateline Bogs
- Oak and Double Oak Mountains
- Oakmulgee District, Talladega National Forest
- Pike County Pocosin Sandhills
- Splinter Hill Bog
- Talladega Mountains
- Tallahatta Bluffs
- Tensaw Delta
- Tom Cat Prairie
- Upper Cahaba Watershed
- Weisner Mountain

## Swamp



Blue Gurth Swamp, Dallas County

George Folkerts



### Description and Location

Swamps are regularly flooded forested areas dominated to varying degrees and composition by cypress, tupelo, and wetland oaks, often with substantial shrub or herbaceous vegetation. Many swamps develop in stream floodplains, where there is considerable overlap in this habitat and Floodplain Forests, but large peat-bottomed “bay” swamps of the Southeastern Plains are not associated with streams, and do not receive over-bank flooding. Floodplain swamps are often created by beaver dams. Coastal tidal-influenced swamps may be flooded twice daily. “Baygall” swamps are mostly evergreen forests generally found at the base of slopes or other habitats where seepage flow is concentrated. Swamps are prone to long-duration standing water, and are normally protected from fire except during extreme droughty periods.

Representative high-quality sites include the Mobile-Tensaw river delta (Mobile, Baldwin counties), Sipsey River Tract (Tuscaloosa County), Wheeler NWR (Morgan County), and Conecuh National Forest (Covington, Escambia counties).

*Encompasses three NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
East Gulf Coastal Plain Tidal Wooded Swamp						X
East Gulf Coastal Plain Nonriverine Basin Swamp						X
Southern Coastal Plain Seepage Swamp and Baygall					X	

### Condition

Much of this habitat has been drained for agriculture or silviculture and inundated by reservoirs. Extensive erosion of uplands, caused by poor agricultural practices dating back to colonial times, transported large amounts of sediment into floodplains and associated swamps. Many exotic plant species have invaded swamps.

**TABLE 4-6. GCN SPECIES, SWAMP**

25 GCN SPECIES include 3 amphibians, 9 reptiles, 8 birds, and 5 mammals. Thirty-five additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (3)</b>		<b>BIRDS (8)</b>	
Southern Dusky Salamander	P1	Henslow's Sparrow	P1
River Frog	P1	Swallow-tailed Kite	P2
One-toed Amphiuma	P2	Wood Thrush	P2
		Kentucky Warbler	P2
		Swainson's Warbler	P2
<b>REPTILES (9)</b>		American Black Duck	P2
Eastern Indigo Snake	P1	Wood Stork	P2
Rainbow Snake	P2	American Woodcock	P2
Eastern Kingsnake	P2		
Speckled Kingsnake	P2	<b>MAMMALS (5)</b>	
Northern Florida Swampsnake	P2	Rafinesque's Big-eared Bat	P1
Coal Skink	P2	Northern Yellow Bat	P2
Southeastern Five-lined Skink	P2	Southeastern Myotis	P2
Alligator Snapping Turtle	P2	Marsh Rabbit	P2
Alabama Red-bellied Turtle	P1	Meadow Jumping Mouse	P2
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Problems Affecting Species/Habitat

- Loss and fragmentation of higher quality habitats from impoundment and conversion to agriculture and/or intensive silviculture [CA1, CA2, CA3, CA6]
- Change in vegetative structure and species composition due to alteration of the natural flood regime due to ditching and draining [CA3]
- Invasive exotic plants (Chinese tallow tree, Japanese climbing fern, privet, etc.) [CA4]
- Scarcity of mature forest characteristics (cavities, snags, hollows) due to harvest rotations [CA6]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R6]
- Insufficient conservation-related educational outreach about biologically significant areas [CA2, CA3, CA5, CA6]
- Fire suppression and lack of fire [CA7]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d).

- R1. **Swallow-tailed Kite:** Systematic surveys should be conducted during breeding season (March-June) for nest locations and during post breeding dispersal (July-August) for communal roost locations in favorable habitats within the Southeastern Plains and Southern Coastal Plains ecoregions. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or

- expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Swainson's Warbler** – Distributional surveys are needed in documented habitat types (e.g., canebrakes of bottomland forests, fragments of old growth bottomland forests, early seral stages of deciduous bottomland forests, and second-growth bottomland forest with scrub palmetto undergrowth). *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **All GCN Warblers and Wood Thrush** – Monitor reproductive success to determine limiting factors for populations. *Product(s)*: Identification of limiting factors, habitat requirements and/or threats for GCN species population.
- R4. **Southern Dusky Salamander** – Intensive surveys of large river floodplains (Mobile, Tensaw, Conecuh, Yellow, Pea, Choctawhatchee, and Chattahoochee Rivers) and swampy creeks (in the Escatawpa, Mobile Bay, and Perdido drainage basins) near the Florida border should be made to define the species' explicit geographic distribution in Alabama. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. **One-toed Amphiuma** – A survey of likely river bottom habitats (Mobile, Tensaw, Perdido, Conecuh, Choctawhatchee, Chipola, and Chattahoochee Rivers) should be conducted. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R6. **River Frog** – A complete survey of distribution should be conducted including all historic localities and other sites with suitable habitat on both private and public lands. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts. Work with **NAWCA, Forest Legacy, Land Trusts, TNC** and other partners to protect significant blocks of high quality examples of this habitat. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Provide incentives and information to landowners for long-term conservation. Potential partners: **NRCS, USFWS** and other granting agencies or institutions. *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Avoid/discourage conversion to agriculture or other forest types, and encourage restoration of altered habitats. Potential partners: **NRCS, USFS, AFC, AFA**. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).



## Chapter 4: Conservation Actions

- CA4. Control exotic plant and animal species. Potential partners: Alabama Invasive Pest Plant Council (**ALIPPC**) **NRCS**, **USFS**, **AFC**. *Performance measures:* Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA5. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS**, **PIF** **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

**High Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA6. Encourage managers and landowners to favor mature and old-growth stands. Potential partner: **AFC**. *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA7. Investigate effects of season and intensity of prescribed fire as a management technique. Potential partner: **AFC**. *Performance measure:* Research project(s) that determine effects of prescribed fire on this key habitat.

**Priority Areas for Conservation Action**

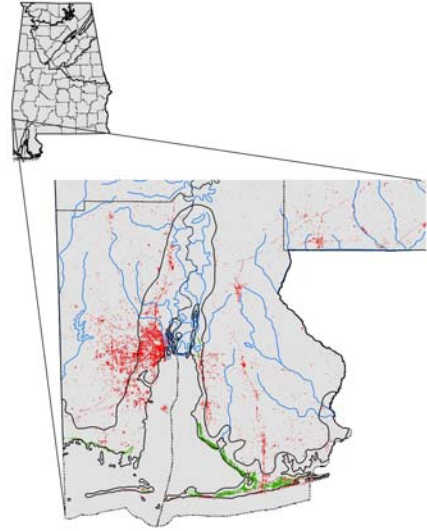
- Ballplay Swamp
- Conecuh National Forest
- East Alabama Fall Line Hills
- Fort Benning
- Ft. Toulouse – Jackson Park
- Lower Alabama River Bluffs and Swamps
- Lower Black Warrior Swamps
- Lower Cahaba Bluffs and Swamps
- Lower Tombigbee River
- Noxubee Prairies and Forests
- Sipsey River
- Tensaw Delta
- Wheeler NWR / Redstone Arsenal

## Maritime Forest and Coastal Scrub



Sand Pine Coastal Scrub, Baldwin County

George Folkerts



### Description and Location

This mosaic of woody vegetation, often dominated by live oak, is present on barrier islands and near-coastal strands. Such areas include relatively stabilized coastal dunes, sometimes with a substantial shell component. Vegetation structure and composition are influenced by salt spray, coastal winds, and extreme disturbance events, especially hurricanes. The most heavily salt-influenced examples may appear pruned or sculpted. Fire is infrequent.

Although spring migrant birds typically expend energy to fly farther inland before making first landfall, these coastal forests are of critical importance to bird survival during so-called “fallout” conditions--when weather is inclement and birds are near exhaustion. In Alabama, this habitat is primarily found south of the Intracoastal Waterway from Perdido Bay to Fort Morgan in Baldwin County, and along Mobile Bay and on Dauphin Island in Mobile County.

Representative high-quality sites include portions of Bon Secour NWR and the inland portion of Gulf State Park east of the golf course (Baldwin County).

*Encompasses one NatureServe Ecological System:*

East Gulf Coastal Plain Maritime Forest

Ecoregion					
IP	SA	RV	P	SP	SCP
					X

### Condition

The location of Alabama's remaining maritime forest and coastal scrub habitats is fairly well known, and virtually all is highly fragmented. Most has either been lost entirely to coastal development (i.e., homes, resorts, golf courses, shopping areas) or is interspersed with houses.



**TABLE 4-7. GCN SPECIES, MARITIME FOREST AND COASTAL SCRUB**

21 GCN SPECIES include 2 amphibians, 9 reptiles, 4 birds, and 6 mammals. Twenty-seven additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (2)</b>		<b>BIRDS (4)</b>	
Gopher Frog	P1	Reddish Egret	P2
Dusky Gopher Frog	P1	Swallow-tailed Kite	P2
		Wood Thrush	P2
		American Woodcock	P2
<b>REPTILES (9)</b>		<b>MAMMALS (6)</b>	
Eastern Indigo Snake	P1	Rafinesque's Big-eared Bat	P1
Southern Hognose Snake	P1	Alabama Beach Mouse	P1
Eastern Diamondback Rattlesnake	P2	Perdido Key Beach Mouse	P1
Eastern Kingsnake	P2	Northern Yellow Bat	P2
Speckled Kingsnake	P2	Long-tailed Weasel	P2
Eastern Coral Snake	P2	Eastern Spotted Skunk	P2
Florida Pine Snake	P2		
Gopher Tortoise	P2		
Southeastern Five-lined Skink	P2		
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Problems Affecting Species/Habitat

- Loss of habitat to development [CA1, CA2, CA3, CA5]
- Fragmentation of habitat by roads, development, utilities, etc. [CA1, CA2, CA3, CA5]
- Predation by elevated urban populations of natural predators, especially raccoons [CA4]
- Predation by free ranging and/or feral cats and dogs. Free-ranging cats are particularly a problem at the State Park property at Florida Point. [CA4]
- Invasive exotic plants (cogongrass) and animals (fire ants) [CA4]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. However, with the exception of the beach mice, none has a special dependence on this habitat type. [R1 – R2]
- Insufficient conservation-related educational outreach about biologically significant areas [CA2, CA6]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d).

- R1. Alabama and Perdido Key beach mice** – The extent to which these species utilize Coastal Scrub (as opposed to Beach and Dune) needs further investigation. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of beach mice and their habitats.

- R2. **Neotropical migrant songbirds** (all species, regardless of GCN status) – determine/document extent of use of these habitats during both fall and spring migration. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of neotropical migrant songbirds and their habitats.

#### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts of undeveloped coastal lands (**MBNEP**, **Bon Secour NWR**, **Forest Legacy**, **TNC**, **Land Trusts** and other partners). *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Provide incentives and information to landowners for long-term conservation (**NRCS**, **USFWS**, and other granting agencies or institutions). *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Avoid/discourage additional development (**MBNEP**, **ADEM**, **SLD-Coastal**, **Baldwin and Mobile Counties**)
- CA4. Control exotic plant and animal species (**NRCS**, **USFS**, **AFC**, **ABC**). The feral cat population at Florida Point needs immediate attention. *Performance measures*: Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA5. Support full implementation of the **NMEP** Comprehensive Conservation and Management Plan, **PIF** bird conservation plans and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **NMEP**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

#### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA6. Develop and disseminate educational materials, brochures, videos, etc. to educate the public of the value of coastal habitats (**MBNEP**, **NRCS**, **USFWS**, **AFC**). *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

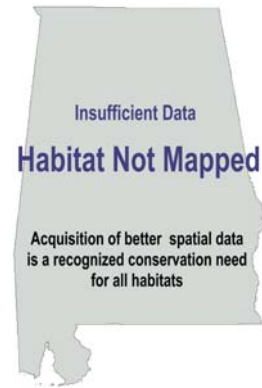
#### Priority Areas for Conservation Action

- Grand Bay Savanna
- Gulf Islands
- Tensaw Delta

## Bogs and Seepage Communities



White-topped Pitcher Plants in a Seepage Bog, Baldwin County George Folkerts



### Description and Location

Several related community types are covered by this category. Seepage bogs, non-boggy seeps, and streamhead seeps occur in the Piedmont and Southeastern Plains. In the Southwestern Appalachians and Ridge and Valley, patches of seepage forests occur on streamhead swales or on broad sandstone ridges where soils are sandy and saturated due to a combination of perched water table and seepage flow. These range in condition from open woodlands to forests. Some may lack a canopy and are dominated by shrubs or herbs. Fire-maintained herbaceous seepage bogs, often containing a variety of carnivorous plants, occur in the Southern Coastal Plain and lower portions of the Southeastern Plains. These are generally found on gentle, almost imperceptible slopes maintained by constant seepage zones and/or perched water tables. Examples are typically grass and sedge dominated, and are often species-rich. Shrubs frequently encroach in the absence of fire. In portions of the Fall Line Hills of the Southeastern Plains, wet, shrub-dominated seepage communities occur in small patches on steep slopes within a matrix of longleaf pine-dominated vegetation. Wetland conditions are maintained by seepage flow from adjacent uplands. Examples of this habitat can vary between densely shrubby and fairly open and herbaceous, depending on frequency of fire and length of time since previous fires.

These are all readily distinguished from adjacent upland habitats by the presence of wetland flora and soils, as well as seepage. They may be somewhat less clearly distinguished from adjacent floodplain habitats, but they are saturated without having standing water as floodplain pools do. These differences are reflected in the vegetation.

*Encompasses four NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southern Piedmont Seepage Wetland				X		
Cumberland Seepage Forest		X	X			
East Gulf Coastal Plain Herbaceous Seepage Bog						X
East Gulf Coastal Plain Interior Shrub Bog					X	

**TABLE 4-8. GCN SPECIES, BOGS AND SEEPAGE COMMUNITIES**

<b>15 GCN SPECIES</b> include 1 crayfish, 2 amphibians, 3 reptiles, 6 birds, and 3 mammals. Twenty-five additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>CRAYFISHES (1)</b>		<b>BIRDS (6)</b>	
<i>Fallicambarus burrisi</i>	P2	Henslow's Sparrow	P1
		Short-eared Owl	P2
<b>AMPHIBIANS (2)</b>		Northern Harrier	P2
Seepage Salamander	P2	Yellow Rail	P2
Pine Barrens Treefrog	P2	Least Bittern	P2
		American Woodcock	P2
<b>REPTILES (3)</b>		<b>MAMMALS (4)</b>	
Coal Skink	P2	Northern Yellow Bat	P2
Southeastern Five-lined Skink	P2	Marsh Rabbit	P2
Mimic Glass Lizard	P2	Meadow Jumping Mouse	P2
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

Henslow's Sparrow uses grassy bogs and other similar habitats in winter. The Pine Barrens Treefrog occurs exclusively in this habitat. The Coal Skink is apparently a "bog species" in the southern part of the state, but exploits other habitats above the Fall Line. The Seepage Salamander is restricted to streamhead seeps in the Fall Line Hills and Piedmont. Other GCN species use these habitats as well, but are not as heavily dependent on them.

### Condition

Most of Alabama's bog habitats have been degraded or lost to 1) drainage for agriculture and/or silviculture and 2) succession to other forest types resulting from fire suppression. Many have been converted into ponds and others have been damaged by hogs and cattle. Of the original Gulf Coast pitcher plant habitats of the southeastern United States, less than three percent remained as degraded habitat, and less than one percent remained as pristine habitat by the latter part of the twentieth century (Folkerts 1982). Remnant bogs on private and public lands are often in need of prescribed burning, and many may require mechanical removal of established woody species such as titi and red maple.

Representative high-quality sites include Conecuh National Forest (Covington County), Roberta Case Pine Hills Preserve (Autauga County), Grand Bay Savanna Nature Preserve (Mobile County)

### Problems Affecting Species/Habitat

- Loss of habitat through draining and fire suppression [CA1, CA4, CA6]
- Insufficient adjacent upland forested habitat left intact following timber harvest [CA2, CA3, CA4]
- Lack of information on status, distribution, and classification of this habitat type [R5]
- Exotics: tallow tree, cogongrass [CA5]

- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R5]
- Insufficient conservation-related education about biologically significant areas and species [CA4]
- Change in vegetative structure and species composition due to absence of the natural fire regime [CA5, CA6]
- Impacts from excessive soil disturbances from site preparation activities (i.e., fire plow lines) [CA5]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA5]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Henslow's Sparrow** – Implement inventory and monitoring programs in this habitat and others on key public and private lands. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Coal Skink** – Conduct surveys employing drift fences to determine this species' distribution in bog habitats. This poorly known species has been documented from bogs in the Florida panhandle, but not from Alabama. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Pine Barrens Treefrog** – Determine status on private (non-Forest Service) lands in Geneva and Covington counties through calling male surveys; conduct studies on non-breeding ecology to better determine management needs. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Seepage Salamander** – Locate and map seepage habitats where this species occurs. Unless these are identified and excluded/protected from timber harvest, the species will continue to decline. Monitor known populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. A full inventory, classification, and mapping of bogs and associated communities should be undertaken as a high priority. NRCS soil data, consultation with forestry and plant community authorities, and remote imagery should be used. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

**Highest Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts. Work with **Forest Legacy**, **Forever Wild**, **TNC**, and **land trusts**. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Avoid/discourage conversion to other forest types. Work with **USFS**, **AFC**, **AFA**. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA3. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

**High Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA4. Educate landowners and managers of the significance and sensitivity of bog habitats, and discourage their use as livestock areas and conversion to farm ponds. Work with **NRCS**, **USFS**, **AFC**. *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets); and number of bogs restored by removal of livestock or farm ponds.
- CA5. Avoid emergency plowed fire lines through bogs when possible; place fire lines where disturbance to sensitive natural groundcover can be avoided or minimized. Restore topography and natural vegetation where emergency plowed fire lines disrupt natural areas. Work with **AFC**, **USFS**. *Performance measures:* Identification and mapping of sensitive habitats that should be avoided; acres restored, enhanced, and/or protected by fee-simple or easements.
- CA6. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.

**Priority Areas for Conservation Action**

- |                              |                                               |
|------------------------------|-----------------------------------------------|
| • Autauga Sandhills          | • Dillard Bog                                 |
| • Bankhead/Warrior Mountains | • Dry Creek Barrens                           |
| • Bear Creek Ravines         | • Dugger/Talladega Mountains                  |
| • Bibb County Glades         | • East Alabama Fall Line Hills                |
| • Boaz Pond                  | • Fort Benning                                |
| • Bryans Creek/Hugh's Bog    | • Franklin/Marion/Jackson Mountains           |
| • Centre Bog                 | • Grand Bay Savanna                           |
| • Chitwood Barrens           | • Green's Pitcher Plant Bog-Yellow Leaf Creek |
| • Conecuh National Forest    | • Gulf Islands                                |

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- Huntsville Mountains
- Jock Creek
- Little River Canyon
- Longleaf Bog
- Lookout and Pigeon Mountains
- Lower Alabama River Bluffs and Swamps
- MS-AL Stateline Bogs
- Oakmulgee District, Talladega National Forest
- Splinter Hill Bog
- Spring Creek
- Talladega Mountains
- Tensaw Delta

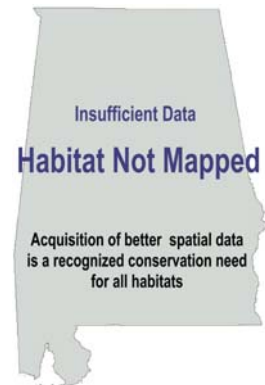


## Glades and Prairies



Cedar Glade, Russell County

George Folkerts



### Description and Location

Naturally treeless areas called glades, barrens, and prairies support plants and animals not typically found in surrounding forests.

**Glades**, sometimes called **barrens**, are open habitats dominated by herbaceous plant communities occurring on uplands, typically on the thin soils of bedrock, and bare rock outcrops may also be present. Historically they had little agricultural value but have been used as rough pasture and for home sites, quarries, and dumps. Limestone (calcareous) glades and barrens are the most widespread type in Alabama, particularly in the Interior Plateau, but glades and barrens also form over sandstone, granite, and other bedrock in the Southwestern Appalachians, Ridge and Valley, and Piedmont. The absence of a tree canopy exposes the ground to considerable sunlight, resulting in very hot surface temperatures in summer. The thin soils of some glades and barrens often hold little water and produce a highly xeric habitat that is inhabited by a highly adapted plant and animal species. Although few vertebrate wildlife species are dependent upon glades and barrens, these habitats support a high number of endemic plants. Representative high-quality limestone **glade** sites include Bibb County Glade Preserve, Prairie Grove Glades Preserve (Lawrence County); sandstone glade sites include Little River Canyon (DeKalb and Cherokee counties), Guntersville State Park (Marshall County). There are no permanently protected granite outcrops in Alabama.

*Encompasses seven NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southern Piedmont Glade and Barrens				X		
Southern Piedmont Granite Flatrock				X		
Cumberland Sandstone Glade and Barrens		X				
Alabama Ketona Glade and Woodland			X			
Southern Ridge and Valley Patch Prairie			X			
Central Interior Highlands Calcareous Glade and Barrens	X	X				
East Gulf Coastal Plain Black Belt Calcareous Prairie and Woodland					X	

**TABLE 4-9. GCN SPECIES, GLADES AND PRAIRIES**

14 GCN SPECIES include 4 reptiles, 8 birds, and 2 mammals. Thirty-five additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).		
<b>BIRDS (8)</b>		
	Henslow's Sparrow	P1
	Bewick's Wren	P1
	Short-eared Owl	P2
	Northern Harrier	P2
	American Kestrel	P2
	Southeastern American Kestrel	P2
	American Woodcock	P2
	Yellow Rail	P2
<b>REPTILES (4)</b>		
Prairie Kingsnake	P2	
Speckled Kingsnake	P2	
Northern Pine Snake	P2	
Coal Skink	P2	
<b>MAMMALS (2)</b>		
	American Black Bear	P1
	Meadow Jumping Mouse	P2
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.		

**Prairies** are grasslands on deeper, fertile soils with herbaceous vegetation maintained by fire and grazing. These natural grasslands generally were treeless and supported a mix of grasses and forbs. Besides having few, if any, large trees, they differ from wet pine savanna and flatwoods communities in having less sandy soil and drier site characteristics. In Alabama, prairies are primarily associated with the Blackland Prairie subdivision of the Southeastern Plains, which contains fertile alkaline soils derived from chalk, marl, and limestone. In most cases individual prairie openings are small and isolated from one another, but they were more extensive prior to European settlement, forming a mosaic of grasslands and woodlands under frequent fire regimes. The fertile “Black Belt” prairie soils of Alabama and Mississippi were one of the most important agricultural areas of the antebellum South, and much of the natural vegetation of the region has been converted to pasture and agricultural uses, but even old-field vegetation reflects the distinctive composition of the flora and ecological dynamics. The flora has much in common with the Midwestern prairies, but locally endemic vertebrates are absent. Many eastern animals, however, including rare birds and reptiles, often use these open habitats.

Representative high-quality blackland prairie sites include Jones Bluff Corps of Engineers Park (Autauga County), Old Bluffport Nature Preserve (Sumter County), China Bluff Corps of Engineers Park (Sumter County); Coosa Valley prairie sites are on Pelham Range (Calhoun County). No permanently protected Jackson prairies are in Alabama.

### Condition

Prior to European settlement, glades and barrens were more widespread and adjoined forests with more open understories than those found today. By the end of the twentieth century, these treeless areas were greatly reduced because of conversion to agriculture, quarrying, altered fire regimes, and the extirpation of two large native grazers, the bison and eastern elk.

Only remnants (perhaps less than 1 percent) of Alabama's Blackland Prairie grasslands existed intact by the end of the twentieth century, because almost all of the region's fertile soils were converted to agriculture. Historically, a combination of fire and grazing (first by native ungulates including bison and elk, and then by free-ranging cattle) kept prairies open. Two centuries of cultivation and disturbance has left few prairies remaining. Range enclosure and fire suppression increased during the twentieth century, changing the dynamics of the landscape, and the coverage of fire-intolerant woody species increased. The formerly extensive Blackland Prairie grassland habitats are now reduced to patches, or its flora persists in pastures which are under more continuous grazing pressure than the former processes would have allowed. Some of the lands are now reverting back to prairie after being abandoned. More recently, lands are being converted to fescue pasture; other abandoned lands have become cedar glades.

### Problems Affecting Species/Habitat

- Fire suppression [CA2, CA4, CA6]
- Conversion of prairie grasslands to pasture [CA1, CA2, CA3, CA4]
- Concentrated grazing pressure on prairie grasses by fenced livestock [CA1, CA3, CA4]
- Quarrying of bedrock at glades and barrens [CA8]
- Use of glades as illegal garbage dump sites [CA8]
- Urban development and habitat fragmentation [CA1, CA4, CA7]
- Exotic species: bermudagrass, bahia, tall fescue, cogon grass [CA2, CA5]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R3]
- Impacts from excessive soil disturbances from site preparation activities (i.e., fire plow lines) [CA5]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA5]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Northern Harrier, Short-eared Owl, American Kestrel** – Survey prairies for these species, determining degree of importance as wintering habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN species; identify habitat requirements for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Prairie Kingsnake** – Implement inventory and monitoring programs on key public and private lands. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. Develop better maps of the distribution of glade, barrens, and prairie communities. A full inventory, classification, and mapping of these habitats should be undertaken as a high priority. NRCS soils data, consultation with forestry and plant community authorities, and remote imagery should be used. *Product(s)*: Data to fill information

gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant tracts. Promote large, unfragmented tracts by working with **USFWS**, **TNC** and other land conservation partners to identify, conserve and restore such tracts. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Encourage maintenance of grassland through prescribed burning. Acceptance of controlled burning can be enhanced through public education, programs to “fire-safe” properties, and cost-share programs to install fire lines and conduct controlled burns. *Performance measures:* Acres burned annually; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets); number of properties made “fire-safe” annually; and number of cost-share programs to install fire lines and conduct controlled burns.
- CA3. Coordinate and integrate existing initiatives and programs such as the **Northern Bobwhite Conservation Initiative** (NBCI) to influence habitat for birds and other wildlife by working with ADCNR, **USFWS**, and **NRCS**. *Performance measures:* Acres of habitat enrolled in **NBCI** and other programs; and number of joint projects with **ADCNR**, **USFWS** and **NRCS**.
- CA4. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA5. Avoid or minimize plowed fire lines when possible; place fire lines where disturbance to sensitive natural groundcover can be avoided or minimized. Restore topography and natural vegetation where emergency plowed fire lines disrupt natural areas. Work with **AFC**, **USFS**. *Performance measures:* Identification and mapping of sensitive habitats that should be avoided; acres restored, enhanced, and/or protected by fee-simple or easements.
- CA6. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.
- CA7. Encourage thinning of overstocked pine forests by working with **AFC**. *Performance measures:* Acres restored or enhanced by thinning of overstocked pines.
- CA8. Discourage/avoid conversion of glades and barrens to mine sites and illegal garbage dump sites. Restore topography and natural vegetation where possible. *Performance measures:* Acres restored; completion of an outreach plan; outreach products

## Chapter 4: Conservation Actions

produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

**Priority Areas for Conservation Action**

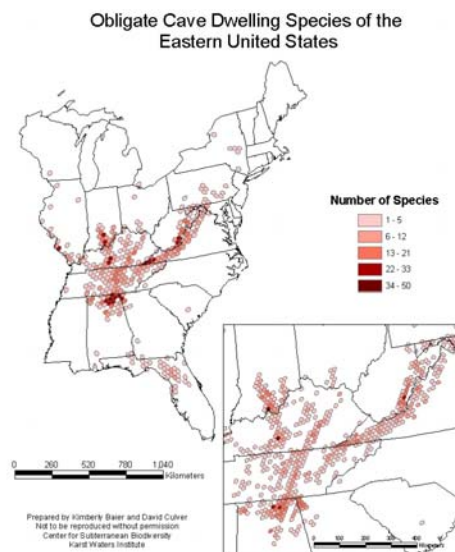
- Almond Outcrop
- Bald Rock Mountain
- Bankhead/Warrior Mountains
- Bear Creek Ravines
- Bibb County Glades
- Black Creek Sandstone Glade
- Blake's Ferry Outcrop
- Buck Island Glades
- Cane Creek/Little Mountain
- Cedar Plains Glades
- Chitwood Barrens
- Coon Gulf
- Coosa Valley Prairies
- Dry Creek Barrens
- Ellisville Prairie
- Ft. Tombecbe – Jones Bluff
- Huntsville Mountains
- Jones Bluff
- Little River Canyon
- Lookout and Pigeon Mountains
- Lower Alabama River Bluffs and Swamps
- Moss Rock
- North Fork Creek Glade
- Noxubee Prairies and Forests
- Old Bluffport
- Old Cahaba Prairies
- Osborne Hill Barrens
- Pelham Range Prairie
- Prairie Bluff – Millers Ferry Prairie
- Prairie Grove Glades
- Rock Creek Barrens
- Skirum Bluff
- Spring Valley
- Srygley Barrens
- Sunny Home Glades
- Thorne Glade
- Tilden Carlowville Prairie Complex
- Tiller's Outcrop
- Wheeler NWR / Redstone Arsenal

## Caves and Mines



Lim Rock Blowing Cave, Jackson County

George Folkerts



### Description and Location

Caves are unique and sensitive environments that harbor rare animal life, as well as fragile mineral formations and valuable ground water resources. Caves in our region are generally created by water dissolving away limestone over millenia. Caves depend on outside sources of detritus (plant material) and bat guano for energy flow and are threatened by changes in the quantity and quality of water flowing from terrestrial sources (Kingsbury and Gibson 2002).

Over 4,000 caves have been documented in Alabama, primarily in the Southwestern Appalachians and Interior Plateau, but caves also occur in the Ridge and Valley and Southeastern Plains. Caves are of tremendous importance to many mammals, amphibians, fishes, crustaceans, insects, arachnids, and other invertebrates. Hundreds of animals--mostly invertebrates--have evolved to survive in these dark, damp, stable habitats, and many species are known from only one or two caves. Jackson County alone harbors 24 obligate cave species that exist no place else (NatureServe 2004b). Studies by Dr. David Culver and others at the Karst Waters Institute have identified northeast Alabama as one of the major "hotspots" for cave animal diversity in the United States (Figure 2-3).

Underground crevices, rock piles, pools, and streams provide critical habitat to invertebrates, salamanders, and fishes, some with extremely limited dispersal capabilities. The "twilight zones" near cave entrances are also utilized by a number of less specialized species. Seasonal bat and reptile hibernation is common. Transient and seasonal cave-related amphibians and reptiles require healthy dispersal and foraging habitat outside the cave itself.

Many of the larger species, such as blind fishes and salamanders, are vulnerable to extinction because of narrow physiological tolerances, long-delayed reproduction, and low reproductive outputs, traits that may have been selected because of their historically stable cave environments (White *et al.* 1995).



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Abandoned *mines* are not inhabited by most cave-dwelling species, but may provide “cave-like” conditions that are exploited by more mobile wildlife such as bats and some amphibians and reptiles.

Representative high-quality cave sites include Blowing Wind Cave NWR (Jackson County), Key Cave NWR (Lauderdale County), Newsome Sinks (Morgan County).

TABLE 4-10. GCN SPECIES, CAVES AND MINES

14 GCN SPECIES include 5 crayfishes, 1 fish, 1 amphibian, and 7 mammals. Three additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>CRAYFISHES (5)</b>		<b>MAMMALS (7)</b>	
<i>Cambarus veitchorum</i>	P1	Gray Myotis	P1
<i>Orconectes sheltai</i>	P1	Indiana Bat	P1
<i>Procambarus pecki</i>	P1	Rafinesque's Big-eared Bat	P1
<i>Cambarus hamulatus</i>	P2	Little Brown Bat	P2
<i>Cambarus jonesi</i>	P2	Northern Myotis	P2
		Southeastern Myotis	P2
		Allegheny Wood Rat	P2
<b>FISHES (1)</b>			
Alabama Cavefish	P1		
<b>AMPHIBIANS (1)</b>			
Tennessee Cave Salamander	P2		
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Condition

The health of these underground habitats is heavily influenced by surface activities. Airflow, microclimate, water quality, organic influx, and hydrology can all be impacted by land management within the recharge area. Disturbances by human visitors can also influence the quality of subterranean systems. Survival of cave ecosystems depends on successful management of terrestrial systems and water quality.

Several caves have been acquired and/or gated for protection of federally listed bats. Blowing Wind Cave, the most important summer cave known for gray bats, has been acquired by USFWS and a gate has been placed across the entrance. Fern Cave, the largest known gray bat hibernaculum, has also been purchased by USFWS and is being managed for protection of the bats. A list of priority gray bat caves is provided in the Gray Bat Recovery Plan (USFWS 1982).

### Problems Affecting Species/Habitat

- Water quality degradation in watershed [CA2, CA6, CA7]
- Human disturbance to bat hibernacula and maternity roosts [CA1, CA3, CA5]



- Interruption of normal air flow/temperature regimes [CA7]
- Habitat loss due to development and conversion from natural habitats to intensively managed plantations and/or agriculture [CA1, CA2, CA4]
- Lack of data on status, distribution, abundance, ecology, life history, threats and habitat requirements for this natural community and GCN species [R1 – R6]
- Insufficient conservation-related education about biologically significant areas and species [CA3, CA4, CA5]
- Improper use of pesticides near streams and wetlands [CA2]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. All GCN **bats** are in need of distribution surveys, investigations of habitat requirements and life histories and long-term quantitative monitoring. Known bat populations should be censused at least every two years to monitor population trends. *Product(s):* Data to fill information gaps to determine the abundance, distribution, long-term status and condition of GCN bats, allowing identification of needed conservation actions; identification of limiting factors, habitat requirements and/or threats for GCN bats; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Indiana Myotis** – Efforts should be made to locate summer habitats using mist netting or remote sensing techniques, such as the Anabat system. *Product(s):* Identification of habitat requirements for this GCN species population; data to fill information gaps for mapping abundance and distribution of this GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Rafinesque's Big-eared Bat, Little Brown Bat, Southeastern Myotis** – Efforts should be made to better determine the winter and summer distribution of these poorly known species. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Tennessee Cave Salamander** populations should be monitored every three to five years. *Product(s):* Data to fill information gaps to assess the status and/or condition of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. **Alabama Cavefish** need continued monitoring at Key Cave to address gaps in knowledge and to assess any negative impacts from urban developments within the recharge area. Any unsurveyed caves in the vicinity of Key Cave should be examined for additional populations. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN species, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R6. **Cave shrimp**, although not treated as GCN in this CWCS, are in need of further attention. Preliminary results of a genetics study of the Alabama cave shrimp (*Palaemonias alabamae*) and the undescribed Tuscumbia cave shrimp (*Palaemonias*

sp. cf. *alabamae*) support the recognition of the Tuscumbia cave shrimp from two privately owned caves in Colbert County as a distinct species, which may result in its eventual federal protection, as is presently afforded to the Alabama cave shrimp. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of cave shrimp, allowing identification of needed conservation actions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Acquire and protect, through proper gating and restricted usage, high-priority caves. Work with **USFWS**, **TNC**, **National Speleological Society**, **Southeastern Cave Conservancy**, **American Cave Conservancy**, **Karst Waters Institute**, and other conservation partners to identify, conserve and restore such caves. *Performance measures*: Number of caves restored, enhanced, and/or protected by fee-simple or easements; number of caves protected by proper gates and restricted usage.
- CA2. Acquire or purchase conservation easements to protect surface habitats and watersheds of all caves supporting sensitive aquatic species such as Alabama Cavefish and Tennessee Cave Salamander, and areas of high cave density (such as Newsome Sinks) by working with **Forest Legacy** and land trusts such as **TNC**, the **Alabama Forest Resources Center**, **Alabama (Chattowah Open) Land Trust**, and the **Land Trust of Huntsville and North Alabama**. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA3. Exclude all but legitimate scientific access to those caves serving as critical habitat to imperiled species. Work with landowners and caver's groups such as **National Speleological Society** to restrict recreational caving to sites and seasons that will result in minimal impacts. Some bat caves may be entered at certain seasons without causing harm. *Performance measures*: Number of caves restored, enhanced, and/or protected by restricting access by user and/or season.
- CA4. Identify recharge areas for ecologically significant caves (surface disturbance and pollution distant from cave entrances can impact cave fauna). **NSS**, **AGS**, **NRCS**, **USFWS**. *Performance measures*: Number of caves with recharge areas identified.
- CA5. Encourage ecologically sensitive forestry practices on steep slopes around caves and sinks (**AFA**, **AFC**, **NRCS**). *Performance measures*: Number of forest management plans containing specific language addressing cave protection needs.
- CA6. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

#### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA7. Educate spelunkers and other cave visitors who may unintentionally disturb bats and other cave-dwelling species. Partner with the **National Speleological Society** and the **American Cave Conservancy**. *Performance measures*: completion of an

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outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

- CA8. Support/promote efforts to reduce persistent pesticides, sediments, and other pollutants in the surface groundwater recharge area by working with **USFWS**, **NRCS**, and local partners. *Performance measures:* **ADEM** water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing water quality monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA9. Where absent, restore forested buffers around cave entrances to provide dispersal/foraging habitat for some species while improving water and air quality and temperature regimes. Partner with **AFC** and **USFS** among others. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.

**Priority Areas for Conservation Action**

- Bankhead/Warrior Mountains
- Conecuh National Forest
- Franklin/Marion/Jackson Mountains
- Honeycomb Creek Karst
- Huntsville Mountains
- Lookout and Pigeon Mountains
- Newsome Sinks
- Nickajack Cove
- Turk's Cave
- Upper Cahaba Watershed
- Upper Gurley Creek

## ***Isolated Wetland***



Flatwoods Pond, Covington County

Mark Bailey



### **Description and Location**

Wetlands surrounded by upland and not drained by streams may be found almost anywhere in Alabama, with somewhat higher densities in the Interior Plateau and Southeastern Plains regions. These are “embedded” habitats in that they may be surrounded by other habitats discussed in this document, such as Dry Longleaf Pine Forest, Mesic Forest, Maritime Forest and Coastal Scrub, Agricultural and Disturbed, and others. These highly variable habitats form in depressions where precipitation collects (e.g., sinkholes, Citronelle ponds), on former floodplains no longer inundated by seasonal river flows (e.g., oxbow lakes), in swales between coastal dunes (e.g., interdunal ponds) and in other seasonally wet sites. Water depth may vary greatly on a seasonal basis, and may be a meter deep or more in the winter. Many become dry in the summer and do not support fish, making them particularly valuable to certain pond-breeding amphibians. Depending on hydrology and soils, isolated wetlands may vary from open water ponds to herb-, shrub-, or tree-dominated wetlands.

Isolated wetlands are vital habitats for numerous wildlife species, including endangered and threatened birds, reptiles, amphibians, invertebrates, and plants (Moler and Franz 1988, Folkerts 1997, Bailey 1999, Phillips 2002). Many thousands of isolated wetlands exist in Alabama, but they have not been inventoried, so the actual number is unknown. The loss or degradation of these wetlands negatively impacts native fauna, flora, soils, and water quality.

This habitat type also includes many water bodies produced by human actions. Most are ponds built for a variety of reasons including aesthetic appreciation, livestock watering, irrigation, aquaculture, and storm water management. Other isolated wetlands have been created by fragmentation from development where they represent remnants of once larger wetland complexes.

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<i>Encompasses four NatureServe Ecological Systems:</i>	Ecoregion					
	IP	SA	RV	P	SP	SCP
Central Interior Highlands and Appalachian Sinkhole and Depression Pond	X	X	X			
Atlantic and Gulf Coastal Plain Interdunal Wetland						X
East Gulf Coastal Plain Northern Depression Pondshore					X	
Southern Piedmont/Ridge and Valley Upland Depression Swamp			X	X		

Representative high-quality sites include Conecuh National Forest (Covington County), Bon Secour NWR (Baldwin County), Skyline-Martin WMA (Jackson County).

TABLE 4-11. GCN SPECIES, ISOLATED WETLAND

13 GCN SPECIES include 4 amphibians, 2 reptiles, 5 birds, and 2 mammals. Forty-four additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (4)</b>			
Flatwoods Salamander	P1	American Black Duck	P2
Gopher Frog	P1	Least Bittern	P2
Dusky Gopher Frog	P1	Black Rail	P2
Little Grass Frog	P2	American Woodcock	P2
<b>REPTILES (2)</b>		<b>MAMMALS (2)</b>	
Eastern Indigo Snake	P1	Marsh Rabbit	P2
Northern Florida Swampsnake	P2	Meadow Jumping Mouse	P2
<b>BIRDS (5)</b>			
Henslow's Sparrow	P1		
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Condition

Statewide, many isolated wetlands have been ditched, filled, deepened, or otherwise altered. Those surrounded by development, agriculture, or intensive silviculture generally lose much of their biodiversity. Even when “buffers” are left around ponds as a part of Best Management Practices (designed primarily for water quality protection), sufficient upland habitat of amphibians, reptiles, and other wildlife is seldom provided. Because ephemeral ponds are seasonally dry, they may not be recognized as wetlands by land managers and regulatory agencies, and therefore are subject to disturbance and destruction. Many of the most productive and intact isolated wetlands are on publicly owned lands, but good examples occur on private holdings, as well. Until a thorough inventory of isolated wetlands is conducted, their overall status and condition will remain poorly known.

### Problems Affecting Species/Habitat

- Loss of habitat through draining and/or filling [CA1, CA2, CA4, CA5, CA8, CA9]
- Lack of recognition (of some wetland types) and therefore protection by managers and regulatory agencies [CA2, CA5, CA8]

- Insufficient upland habitat provided undisturbed for pond-dependent yet upland-dwelling wildlife following timber harvest, conversion to agriculture, development [CA1, CA5]
- Introduction of game fish to naturally fishless ponds impacts amphibian populations [CA3]
- Lack of information on status, distribution, and classification of this habitat type [R6]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species [R1 – R7]
- Impacts from erosion from mechanized vehicle trails uphill from biologically significant sites [CA6]
- Failure to identify and protect critical and unique habitats embedded in a forest matrix [CA5, CA6, CA8]
- Change in vegetative structure and species composition due to absence of natural fire regime [CA7]
- Erosion from mechanized vehicle trails and other activities near biologically significant sites [CA6]
- Insufficient conservation-related education about biologically significant areas and species [CA2, CA3, CA5, CA8]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Flatwoods Salamander** – Possibly extirpated. Intensive surveys in the southernmost tier of counties are needed to determine whether this species still occurs in Alabama. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Dusky (Mississippi) Gopher Frog** – Possibly extirpated. Intensive surveys in Mobile and Washington counties are needed to determine whether this species still occurs in Alabama. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Gopher Frog** – Annual monitoring of known breeding sites, along with surveys for new populations and assessment of threats, is needed. The area between Montevallo and Columbiana in Shelby County needs particular attention, since the only known population from that region of the state has been extirpated. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; identification of limiting factors, habitat requirements and/or threats for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Little Grass Frog** – Annual monitoring of known breeding sites, along with surveys for new populations and assessment of threats, is needed. Alabama populations appear to be confined to southeastern Houston County. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; identification of limiting factors, habitat requirements and/or threats for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.



- R5. Investigate habitat use and seasonal importance of isolated wetlands to GCN and other migratory shorebirds. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of isolated wetlands and their fish and wildlife.
- R6. A full inventory, classification, and mapping of Alabama's isolated wetlands should be undertaken as a high priority. NRCS soil maps, USGS topographic maps (incorporating existing National Wetlands Inventory maps which exist for some quadrangles), and remote imagery should be used. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.
- R7. Establish baseline species data for amphibians and other wildlife at key representative wetlands to monitor long-term trends. *Product(s)*: Data to fill information gaps to assess the long-term status and/or condition of amphibians and other wildlife; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages

#### . Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect existing significant wetlands. Protect high-quality tracts of forest that contain isolated wetlands. Work with **Longleaf Alliance**, **USFWS**, **TNC** and other land conservation partners to identify, conserve and restore such tracts. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Ensure that isolated wetlands on all publicly owned lands are fully protected from sedimentation (including from graded road "wing ditches"), draining, and destruction. Partners include **ADCNR-SLD**, **AFC**, **EPA**, **USFWS**, **USFS**, and **DoD**. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA3. Remove fish from, and/or prevent stocking of fish in, natural isolated ponds on public lands, and encourage private landowners to maintain some fishless ponds. Work with **NRCS** and **USFS**, whose 2004 Land and Resource Management Plan states, "Do not introduce fish into seasonal or sinkhole ponds." *Performance measures*: Number of ponds restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA4. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.



**High Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA5. Work with large industrial timberland owners (e.g., **International Paper**, **Rayonier**, **Hancock Timber Management**, and others) to encourage identification and protection of significant wetlands and adjacent uplands. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA6. Avoid placing emergency plowed fire lines through dry wetlands when possible; restore topography and natural vegetation where emergency plowed fire lines disrupt wetland basins. Work with **AFC**, **USFS**. *Performance measures:* Identification and mapping of sensitive habitats that should be avoided; acres restored, enhanced, and/or protected by fee-simple or easements.
- CA7. Participate in the **Alabama Prescribed Fire Council**. *Performance measures:* Number of Council meetings attended; number of partnerships with Council to fund and/or implement conservation projects involving prescribed fire.
- CA8. Develop educational materials (brochures, videos, etc.) to inform the public of the importance of ephemeral wetlands. Work with **Legacy**, **AFC**, **TNC**, **PARC**, **PIF**, and others. *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA9. Create artificial wetlands (Biebighauser, 2004) where wetlands have been lost. Partner with **NRCS**, **USFS**, **USFWS**, **PARC**. *Performance measures:* Acres of artificial wetlands created.

**Priority Areas for Conservation Action**

- |                                         |                                |
|-----------------------------------------|--------------------------------|
| • Boaz Pond                             | • Huntsville Mountains         |
| • Cane Creek/Little Mountain            | • Indigo Pond                  |
| • Conecuh National Forest               | • Lookout and Pigeon Mountains |
| • Fort Benning                          | • Mystery Worm Pond            |
| • Franklin / Marion / Jackson Mountains | • Talladega Mountains          |
| • Grand Bay Savanna                     |                                |

## Artificial Habitats



Abandoned Field, Dale County

Mark Bailey



### Description and Location

Heavily disturbed and altered habitats, resulting from human activity, occur in a wide variety of forms statewide and in every ecoregion. The total area of this type exceeds that of natural habitats in some regions such as the Interior Plateau and the Blackland Prairie of the Southeastern Plains. This category includes cropland, sod farms, catfish farms, orchards, pastures, utility and roadway rights-of-way, golf courses, and many other man-made conditions. Structures such as silos, barns, and abandoned buildings may support owls, bats, various reptiles, and other wildlife. Although these habitats support quite different plant and animal assemblages than formerly occurred prior to conversion, remnants of the original natural habitats may still be present. Embedded wetlands, vegetated stream banks, wooded slopes adjacent to fields, and other non-cultivated areas (even fencerows and irrigation ditches) may serve as important patches of “natural” habitats in which wildlife species can survive and from which they may disperse. Many wildlife species will disperse into agricultural lands to forage or to migrate to other natural habitats. For this reason, it is important to maintain and create corridors of suitable habitat connecting fragmented habitats within agricultural lands. Although this habitat is of low importance to most GCN species and none are dependent on it, several species may occur under certain conditions. For example, in some areas of the Southeastern Plains where adjacent forest is either too dense or fire-suppressed, gopher tortoises are all but relegated to disturbed, open habitats, especially transmission line rights-of-way.

### Condition

“Condition,” for this artificial habitat type, is somewhat subjective, since there is no benchmark natural condition for comparison. Restoration to the original pre-conversion habitat is generally not an option, except when these lands are included in larger tracts that are specifically set aside for wildlife conservation. Invasive exotic species such as fire ants, kudzu, and privet are common in these disturbed areas. Pasture grasses such as Bermuda grass and bahia may retard natural succession to woodland long after these habitats cease to be used for agriculture.

**TABLE 4-12. GCN SPECIES, ARTIFICIAL HABITATS**

13 GCN SPECIES include 2 reptiles, 10 birds, and 1 mammal. Twenty-eight additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>REPTILES (2)</b>			
Gopher Tortoise	P2	American Kestrel	P2
Prairie Kingsnake	P2	Southeastern American Kestrel	P2
		Wood Stork	P2
<b>BIRDS (10)</b>			
Henslow's Sparrow	P1	Kentucky Warbler	P2
Bewick's Wren	P1	American Woodcock	P2
Bachman's Sparrow	P2		
Short-eared Owl	P2	<b>MAMMALS (1)</b>	
Northern Harrier	P2	Brazilian Free-tailed Bat	P2
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

### Problems Affecting Species/Habitat

- Emphasis on “clean” agriculture (lack of weedy, brushy fencerows) reduces available habitats for many species. [CA4, CA5]
- Invasive exotic plants (kudzu, Chinese tallow tree, cogongrass, privet, etc.) and animals (fire ants) [CA10]
- Loss of older farm buildings which provide wildlife habitat [CA11]
- Scarcity of cavities [CA1]
- Improper use of fertilizers, herbicides and pesticides near streams and wetlands [CA6]
- Habitat loss through draining of wetlands [CA7]
- Loss of natural community integrity due to disturbance from livestock [CA9]
- Mowing wetlands, shorelines, and ditches mid-spring through midfall during critical time of reproduction and rearing of young for most vertebrate taxa [CA8]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. [R1 – R2, CA2, CA3]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d).

- R1. **American Kestrel/Southeastern American Kestrel** – Conduct surveys for both breeding and wintering habitat use. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN species; identify habitat requirements for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Gopher Tortoise** – Conduct thorough surveys to determine current distribution and status on transmission line rights-of-way. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; identify habitat

requirements for GCN species population; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

It is assumed that uses other than wildlife management are the primary management objective and any GCN species present are relicts. If restoration of the native habitats of these areas is unlikely to occur through purchase or signing of conservation easements, some of the following actions may prolong existence of populations until they can be protected, or ameliorate other negative aspects of the primary use of the land. **NRCS** is the most likely partnering agency, but organizations such as the **Alabama Farmers Federation** and **Alabama Cattlemen's Association** could also be involved. The **Audubon Cooperative Sanctuary Programs** (ACSP) assist landowners in maximizing habitat for wildlife and maintaining the biodiversity of local landscapes.

- CA1. **American Kestrel/Southeastern American Kestrel:** Implement a nest box program in partnership with **AOS, SABA**. Agricultural lands afford excellent foraging, but cavities are limited. *Performance measure:* Number of nest boxes installed annually.
- CA2. **Gopher Tortoise:** Map current distribution on transmission line rights-of-way in partnership with major utilities including **Alabama Power Company, ConocoPhillips**, and others. *Performance measure:* GIS maps produced of all known sites.
- CA3. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS, PIF, USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA4. Encourage land managers to protect and buffer any remaining natural areas. These are the areas where most GCN taxa will persist, or visit. *Performance measures:* Acres of buffer restored, enhanced or created annually; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA5. Encourage land managers to develop naturally vegetated corridors between habitat fragments. *Performance measures:* Number of vegetated corridors restored, enhanced or created; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA6. Encourage golf courses and other large land managers to adopt integrated pest management strategies to reduce chemical use. *Performance measures:* Number of golf courses and other managed lands utilizing integrated pest management; completion of an outreach plan; outreach products produced (e.g., website, frequent

website updates, periodic workshops and symposia and resulting publications, maps and information packets).

- CA7. Encourage land managers to consider restoring natural hydrology to drained wetlands. *Performance measures:* Acres of wetland restored; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA8. Encourage land managers to avoid mowing wetlands, shorelines, and ditches mid-spring through mid-fall. This period is usually a critical time of reproduction and rearing of young for most vertebrate taxa. *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA9. Encourage land managers to avoid overgrazing and keep livestock out of wetlands. *Performance measures:* Acres of wetland protected from livestock; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA10. Control/eradicate exotic plants and animals. *Performance measures:* Number of control and/or eradication projects; abundance and distribution of exotic species.
- CA11. Preserve older farm buildings for wildlife use. Partner with **historic preservation organizations** and **land trusts**. *Performance measures:* Number of older farm buildings preserved; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

### Priority Areas for Conservation Action

*Not applicable*



## Beach and Dune



Dunes, Baldwin County

Malcolm Pierson

### Description and Location

Beach and dune complexes are dynamic systems of constantly changing habitats characterized by sandy soils, sparse, saltwater-adapted grasses and shrubs, and interdunal pools and swales. Winds, tides, salt spray and hurricanes impact these habitats as the sands and the vegetation that they support constantly ebb and flow in response.

Vegetated coastal dunes consist largely of herbaceous and embedded shrublands on barrier islands and other near-coastal areas where salt spray, saltwater overwash, and sand movement are important ecological forces. A number of diagnostic and endemic plant species characterize this habitat, including sandhill rosemary (*Ceratiola ericoides*), woody goldenrod (*Chrysoma pauciflosculosa*), beach sand-squares (*Paronychia erecta*), and Gulf rockrose (*Helianthemum arenicola*) (Johnson and Barbour 1990). The outermost zone of vegetation extending seaward from foredunes is characterized by sea oats (*Uniola paniculata*) and Gulf bluestem (*Schizachyrium maritimum*).

Wildlife species of Alabama's beaches and dunes include beach mice, sea turtles, and nesting and wintering shorebirds that are incapable of surviving (or reproducing, in the case of sea turtles) in other habitats, and their welfare is tied to the welfare of this narrow coastal strip.

Representative high-quality sites include portions of Bon Secour NWR, Gulf State Park, Dauphin Island Bird Sanctuary, and Pelican Island.

Encompasses two NatureServe Ecological Systems:	Ecoregion					
	IP	SA	RV	P	SP	SCP
East Gulf Coastal Plain Dune and Coastal Grassland						X
Florida Panhandle Beach Vegetation						X

**Condition**

Alabama's beach and dune systems are extremely attractive to tourists and vacationers. Prior to the landfall of Hurricane Frederick in 1979, development along the Alabama coastline was intermittent and slow. The development of beachfront property over the last 25 years has been dramatic and has driven land prices to extremely high levels. As a result, little undeveloped beachfront property exists in Alabama outside of state and federal ownership.

**TABLE 4-13. GCN SPECIES, BEACH AND DUNE**

12 GCN SPECIES include 4 reptiles, 5 birds, and 3 mammals. Twenty additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>REPTILES (4)</b>			
Loggerhead Sea Turtle	P1	Reddish Egret	P2
Green Sea Turtle	P1	American Oystercatcher	P2
Mississippi Diamond-backed Terrapin	P1		
Eastern Diamondback Rattlesnake	P2	<b>MAMMALS (3)</b>	
		Alabama Beach Mouse	P1
<b>BIRDS (5)</b>		Perdido Key Beach Mouse	P1
Snowy Plover	P1	Marsh Rabbit	P2
Piping Plover	P1		
Wilson's Plover	P1		
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

Because beach and dune complexes are both highly valued for development and also provide critically important habitat for a variety of unique plant and animal assemblages, conflicts have arisen between conservationists and developers regarding the future use of the remaining lands, and those private developments that currently impact the nearby public lands. For example, light pollution from nearby development is particularly disruptive to sea turtle nesting behavior, and free-ranging pets, such as house cats, impose direct mortality on imperiled forms (*e.g.*, beach mice).

**Problems Affecting Species/Habitat**

- Loss of habitat to development [CA1, CA3, CA5, CA6, CA7, CA8, CA9, CA12, CA13]
- Fragmentation of habitat by roads, development, utilities, etc. [CA1, CA5, CA6, CA7, CA8, CA9, CA10, CA12, CA13]
- Nest predation by elevated urban populations of natural predators, especially raccoons [CA3, CA4, CA13]
- Predation (especially on beach mice) by free ranging and/or feral cats. Free-ranging cats are particularly a problem at the State Park property at Florida Point. [CA3, CA4, CA13, CA14]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species. However, with the exception of the beach mice, none has a special dependence on this habitat type. [R1 – R5]



- Impacts from disturbance caused by allowing foot and vehicle traffic through sensitive habitat features such as nest sites [CA2, CA10, CA11, CA13]
- Insufficient conservation-related education about biologically significant areas and species [CA2, CA10, CA11, CA13, CA14]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see **Alabama Wildlife** Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Alabama and Perdido Key beach mice** – Monitor annually. *Product(s)*: Data to fill information gaps to assess the status and/or condition of GCN beach mice; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages
- R2. **Wilson's and Snowy plovers** – Expand nesting surveys beyond public lands to better determine nesting status in Alabama. *Product(s)*: Data to fill information gaps to assess the status and/or condition of GCN plovers; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **American Oystercatcher** – Conduct periodic nesting surveys. Any major hurricane events affecting Alabama should be followed by nesting season surveys. *Product(s)*: Data to fill information gaps to assess the status and/or condition of American oystercatchers; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Piping Plover** – Conduct annual winter surveys on Pelican Island and Little Dauphin Island, participate in the International Piping Plover Survey. Implement other priority actions in the Recovery Plan to conserve this species and improve important wintering habitat in Alabama. *Product(s)/Performance measure(s)*: data to fill information gaps to assess the status and/or condition of piping plovers; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages; acres of wintering habitat restored, enhanced or protected by fee-simple or easements.
- R5. **Nesting sea turtles (primarily Loggerhead; also Green, Ridley)**: Expand annual nesting surveys, continue the annual stranded turtle monitoring program. Implement other priority actions in the Recovery Plans to conserve this species and improve important wintering habitat in Alabama. *Product(s)/Performance measure(s)*: data to fill information gaps to assess the status and/or condition of sea turtles; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages; acres of wintering habitat restored, enhanced or protected by fee-simple or easements.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property, and acquire or purchase conservation easements to protect undeveloped beaches, including the critically important west end of Dauphin Island in partnership with Dauphin Island Bird Sanctuary (**DIBS**) **MBNEP**, **Bon Secour NWR**, **Forest Legacy**, **TNC**, **Land Trusts** and other partners. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.

- CA2. Protect all remaining beach mouse, plover, and sea turtle nesting habitat, by supporting dune restoration on public and private lands, requiring dune-walkovers at all public and private access points, prohibiting all vehicle access to dune habitats, encouraging the use of native planting and landscaping for all areas, and developing bio-friendly tourism initiatives (**MBNEP**, **Bon Secour NWR**, **TNC**, and other partners). *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements; completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets); number of regulatory protections implemented to require dune walkovers and prohibit vehicle traffic on dunes.
- CA3. Cooperate with federal agencies to reestablish Alabama beach mouse populations where possible (**USFWS**, **NRCS**). *Performance measures:* Number of partnerships and/or joint projects with **USFWS**, **NRCS** and others to fund and/or implement Alabama beach mouse population introductions; Alabama beach mouse population status and trends.
- CA4. Develop and enforce feral/free-roaming domestic cat control measures as recently was done in the state of Florida. *Performance measures:* Number of regulatory protections implemented to control feral/free-roaming domestic cat populations.
- CA5. Work to limit all future construction on Fort Morgan Peninsula; examine permitting requirements for single family dwellings (**ADEM**, other appropriate state agencies). *Performance measures:* Number of regulatory protections implemented to limit future construction; number of plans/permits commented on.
- CA6. Institute a ban on all development that would result in actual or potential take of beach mice or their habitat (**ADEM**, other appropriate state agencies). *Performance measures:* Number of regulatory protections implemented to limit future construction; number of plans/permits commented on.
- CA7. Identify developed areas that can be returned to native habitat following catastrophic events (**MBNEP**, **Bon Secour NWR**, **Forest Legacy**, **TNC**). *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA8. Declare all habitat south of Alabama State Highways 180 and 182 as non-redevelopment zones. *Performance measures:* Acres restored, enhanced, and/or protected by creation of a non-redevelopment zone.
- CA9. Develop plans to identify and to return four to five miles of habitat south of Alabama Highway 182 on Perdido Key to a natural state following future hurricane events (**ADEM**, other appropriate state agencies). *Performance measures:* identification of habitat to be restored; key habitats with GIS data compiled; acres restored, enhanced, and/or protected by fee-simple or easements.
- CA10. Use Gulf State Park as a state example of wise and responsible use of beach property. To that end, the following steps are suggested: convert the dune habitat at Gulf State Park to day use, relocate conference center and guest rooms to the interior area of park, and return the dune habitat to its native state. *Performance measures:* Limitation of Gulf State Park dunes to day use; relocation of conference center and guest rooms; acres of dune habitat restored.

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- CA11. Post signs directing the public away from sensitive plover and turtle nesting sites (**MBNEP**, **Bon Secour NWR**, **Gulf State Park**). *Performance measures:* Number of signs posted annually.
- CA12. Provide incentives and information to landowners for long-term conservation (**NRCS**, **USFWS**, and other granting agencies or institutions). *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA13. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures:* Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

**High Priority Conservation Actions Needed and Key Partnership Opportunities**

- CA14. Develop and disseminate educational materials, brochures, videos, etc. to educate the public of the value of coastal habitats (**MBNEP**, **NRCS**, **USFWS**, **AFC**). *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

**Priority Areas for Conservation Action**

- Gulf Islands (including Dauphin Island and Fort Morgan Peninsula)

## ***Estuarine and Marine***



Weeks Bay, Baldwin County

Mark Bailey

### **Description and Location**

Restricted to Alabama's coastal counties of Baldwin and Mobile, this habitat includes salt and brackish tidal marshes and adjacent shallow marine waters, including seagrass beds.

Salt marshes and adjacent shallow waters support many fish species of commercial interest, and are important to a number of other terrestrial and aquatic wildlife species. These habitats are typically associated with mud-bottomed bays behind barrier islands. Some of Alabama's most extensive brackish needlerush marshes are associated with lower Mon Louis Island, Dauphin Island, and Mississippi Sound.

Seagrass meadows are among the most productive habitats in estuarine waters of the Gulf Coast. Seagrasses provide food for wintering waterfowl and important spawning and foraging habitat for commercially important finfish and shellfish. Seagrass communities also support endangered and threatened species, including sea turtles and manatees. Submerged seagrass beds are found in a patchy distribution behind protective barrier islands and in near-shore areas. Beds occur in greater numbers in Perdido Bay, Wolf Bay, and Mississippi Sound, but have become scarce in Mobile Bay, where salinity is relatively low and water quality has declined more markedly. Wigeongrass (*Ruppia maritima*) is tolerant of freshwater and consequently is an important component of this habitat. American wildcelery (*Vallisneria spiralis*) is also a component. Other species such as shoal grass (*Halodule wrightii*), southern naiad (*Najas guadalupensis*) and slender pondweed (*Potamogeton pusillus*) may be present, usually in small beds.

Representative high-quality estuarine sites include Weeks Bay NERR (Baldwin County), Bon Secour NWR (Mobile County), W.L. Holland WMA (Baldwin County). High quality marine sites include offshore hardbottoms and the area known as "The Pinnacles."

<i>Encompasses two NatureServe Ecological Systems:</i>	Ecoregion					
	IP	SA	RV	P	SP	SCP
East Gulf Coastal Plain Northern Gulf of Mexico Seagrass Bed						X
Mississippi Sound Salt and Brackish Tidal Marsh						X

**TABLE 4-14. GCN SPECIES, ESTUARINE AND MARINE**

<b>11 GCN SPECIES</b> include 5 reptiles, 5 birds, and 1 mammal. Fourteen additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).					
<b>REPTILES (5)</b>			<b>BIRDS (5)</b>		
Loggerhead Sea Turtle	P1		Seaside Sparrow		P2
Green Sea Turtle	P1		Nelson's Sharp-tailed Sparrow		P2
Leatherback Sea Turtle	P1		Yellow Rail		P2
Kemp's Ridley Sea Turtle	P1		Least Bittern		P2
Mississippi Diamond-backed Terrapin	P1		Black Rail		P2
			<b>MAMMALS (1)</b>		
			West Indian Manatee		P1
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.					

### Condition

Non-freshwater marshes surrounding Mobile Bay declined by more than 10,000 acres from 1955 to 1979, representing a loss of 35% (Roach et al. 1987), but that decline has slowed in recent years. Losses of seagrass beds in the northern Gulf of Mexico over the last 50 years have been extensive. Most estuaries have lost from 20 to 100 percent of their seagrass beds. Although precise numbers are unknown, it is estimated that 50% or more of Alabama's seagrass beds were lost from the 1940s to 1979 (GMFMC 1998). Coastal population growth and accompanying municipal, industrial, and agricultural development has been recognized as a contributing factor (Neckles 1993). The environmental quality of the habitat has deteriorated with increased turbidity and decreases in water quality resulting from dredging, boating activities, and other development pressures. Losses of seagrasses may signal water quality problems in Alabama's coastal waters.

The Gulf of Mexico Fishery Management Council (GMFMC) and Gulf States Marine Fisheries Commission (GSMFC) have existing management plans for three and seven fisheries respectively. The GMFMC has developed regional Fishery Management Plans for 42 reef fishes (GMFMC and NMFS 2005), red drum (GMFMC 1986), and coastal migratory pelagic species (mackerels; GMFMC et al. 2004). The GSMFC has regional Fishery Management Plans for striped bass (GSMFC 1992), striped mullet (Leard et al. 1993a), black drum (Leard et al. 1993b), Spanish mackerel (Lukens 1989), flounder (VanderKooy 2000), spotted seatrout (VanderKooy 2001), and menhaden (VanderKooy and Smith 2002). The National Marine Fisheries Service has Fishery Management Plans for highly migratory species that can be found in Alabama's waters such as Atlantic billfish (NMFS 1999) and Atlantic tunas,

swordfish and sharks (NMFS 2003). These Fishery Management Plans are supported by Alabama's CWCS and incorporated by reference.

### Problems Affecting Species/Habitat

- Water quality degradation as a result of habitat degradation, nutrient enrichment, pathogens, and toxic chemicals [CA2]
- Loss of estuarine habitat from sedimentation, hydrologic modifications, filling, trawling, dredging, and invasive species [CA1, CA3, CA5]
- Exotic species: tallow tree, torpedo grass, Eurasian water milfoil [CA10]
- Loss of wetland and shoreline habitat due to weak regulatory monitoring, enforcement and inadequate mitigation practices, and inadequate coastal engineering [CA1, CA3, CA4, CA6]
- Mortality due to crab traps (diamond-backed terrapins) and trawling (sea turtles) [R3, CA11]
- Lack of current information on status and distribution of this habitat type [CA12]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species [R1 – R3]
- Impacts from disturbance by allowing foot traffic through sensitive nesting areas [CA4]
- Insufficient conservation-related education about biologically significant areas and species [CA7]
- Loss of and disturbance to marine habitat from marine construction projects (e.g., oil and gas pipelines and platforms), dredge material disposal, and bottom tending fishing gear [CA8, CA9]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species and their conservation actions please see **Alabama Wildlife** Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d).*

- R1. **Black Rail** – Survey potential marsh habitats for this poorly known species. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Green Sea Turtle** – Identify foraging areas in Alabama waters, focusing on areas rich in sea grasses or macroalgae. *Product(s)*: Data to complete or expand GIS coverages for green sea turtle foraging habitat.
- R3. **Mississippi Diamond-backed Terrapin** – Investigate impact of crab traps on this species. Determine distribution, which is at present poorly known. *Product(s)*: Threats assessment of crab traps initiated and completed; data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Develop a coordinated plan with local and federal agencies with regard to acquisition of property or purchase of conservation easements to protect, enhance, restore, and manage undeveloped coastal wetlands (MBNEP 2001). Work with **MBNEP, Grand Bay NWR, TNC, Coastal Land Trust, Forever Wild, SLD-**



**Coastal** and other partners. *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple or easements.

- CA2. Improve water quality by developing allowable water quality-based loadings sufficient to maintain water quality standards (or total maximum daily loads) for pathogens, nutrients, toxic chemicals, and other conventional pollutants, and by support habitat restoration efforts where needed. Work with **MBNEP, ADEM, NRCS, EPA, USACOE**. *Performance measures:* **ADEM** water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; effective monitoring protocols established; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA3. Maintain and protect all types of coastal wetlands within the MBNEP study area (including quality, function, and value) and increase acreage by 5% of those types that have declined (MBNEP 2001). *Performance measures:* Acres of coastal wetland restored, enhanced, and/or protected by fee-simple or easements.
- CA4. Maintain and protect nesting habitat for colonial and migratory birds and reduce declines in nesting habitat due to human disturbance and alteration (MBNEP 2001). *Performance measures:* Acres restored, enhanced, and/or protected by fee-simple, easements, or restriction/removal of human disturbance.
- CA5. Maintain existing native SAVs at 2001 levels and increase acreage of known areas where native SAVs occur (MBNEP 2001). *Performance measures:* Acres of SAV restored, enhanced, and/or protected by fee-simple or easements.
- CA6. Protect existing natural shoreline, beach and dune habitat and restore previously altered habitats, where feasible, including the rehabilitation of altered shoreline (MBNEP 2001). *Performance measures:* Acres of shoreline, beach and dune restored, enhanced, and/or protected by fee-simple or easements.
- CA7. Develop and disseminate educational materials, brochures, videos, etc. to educate the public of the value of coastal habitats (**MBNEP, NRCS, USFWS, AFC**). *Performance measures:* Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).
- CA8. Avoid, minimize, and where unavoidable, mitigate, impacts to sensitive and distinctive marine habitats such as hardbottoms and reefs from marine construction projects (**U.S. Minerals Management Service, GMFMC, GSMFC, NMFS, U.S. Army Corps of Engineers, oil and gas industry representatives**). *Performance measures:* Number of new marine construction projects that avoid, minimize and/or mitigate impacts.
- CA9. Evaluate and, if appropriate, recommend marine habitats for designation as Marine Protected Areas (**National Park Service, USFWS, NMFS, GMFMC, GSMFC, TNC**). *Performance measures:* Acres of habitat protected through Marine Protected Area designation.
- CA10. Control/eradicate exotic species such as tallow tree, torpedo grass and Eurasian milfoil. *Performance measures:* Number of control and/or eradication projects; abundance and distribution of exotic species.

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- CA11. Designate sanctuaries where crabbing and trawling are prohibited and remove abandoned crab traps to reduce mortality of diamond-backed terrapins and sea turtles. *Performance measures:* Acres of estuarine and marine habitat protected by prohibition of crab traps and/or trawling; mortality rates of diamond-back terrapins and sea turtles due to crab traps and trawling.
- CA12. Map current distribution of estuarine and marine habitats including coastal wetlands, SAV and shorelines. *Product(s)/Performance measures:* GIS coverages for this key habitat; data to complete or expand aquatic GAP; data to fill information gaps for mapping abundance and distribution of this key habitat; inclusion in and/or expansion of the **Natural Heritage Database** and/or other ADCNR databases/coverages.

**Priority Areas for Conservation Action**

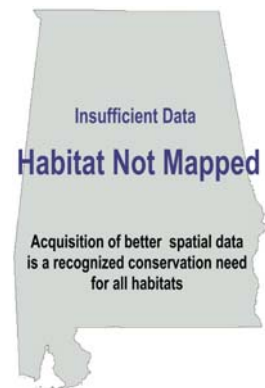
- Grand Bay Savanna
- Gulf Islands
- Gulf of Mexico
- Mobile Bay

## Cliffs and Rockhouses



Walls of Jericho, Jackson County

Eric Soehren



### Description and Location

A variety of habitats include rocky cliffs in the mist zones of waterfalls, dry sandstone and limestone escarpments and bluffs above river gorges, talus fields on steep slopes, sheltered, cave-like “rockhouses” of the Southwestern Appalachians, and chalk river bluffs of the Blackland Prairie. One or more of these habitats occur virtually statewide. Portions of the Southeastern Plains may be nearly lacking these habitats, but the Buhrstone/Lime Hills and Blackland Prairie subdivisions contain numerous examples. Difficult to detect from aerial or satellite imagery, many can be identified from topographic maps. Vegetation is usually sparse, and may consist primarily of lichens, ferns, and small woody shrubs. Where trees occur, they are often stunted, and may represent “hidden old growth” that does not appear to be as old as it is.

Occasional rock falls and scouring related to flash floods are natural catastrophic disturbances. Fire probably has little effect on cliffs, which have too little vegetation to carry fire and which tend to occur in topography that is not conducive to fire spread.

No GCN species are restricted to this habitat, and relatively few use it, but it is of primary importance to at least three: Allegheny Woodrat, Rafinesque’s Big-eared Bat, and Green Salamander.

*Encompasses seven NatureServe Ecological Systems:*

	Ecoregion					
	IP	SA	RV	P	SP	SCP
Southern Appalachian Spray Cliff		X	X			
Southern Interior Acid Cliff		X				
Southern Appalachian Montane Cliff and Talus		X				
Allegheny-Cumberland Sandstone Box Canyon and Rockhouse		X				
Southern Interior Calcareous Cliff	X	X				
Southern Interior Sinkhole Wall	X	X	X			
Southern Piedmont Cliff				X		

**TABLE 4-15. GCN SPECIES, CLIFFS AND ROCKHOUSES**

6 GCN SPECIES include 1 amphibian, 1 reptile, 1 bird, and 3 mammals. Ten additional watch list (Priority 3) species are considered to be of Moderate Conservation Concern (Mirarchi 2004).			
<b>AMPHIBIANS (1)</b>		<b>BIRDS (1)</b>	
Green Salamander	P2	Common Raven	EX
		<b>MAMMALS (3)</b>	
<b>REPTILES (1)</b>		Rafinesque's Big-eared Bat	P1
Coal Skink	P2	Allegheny Woodrat	P2
		Pygmy Shrew	P2
EX: Extirpated – No longer known to occur in Alabama			
P1: Priority 1 – Highest Conservation Concern. P2: Priority 2 – High Conservation Concern.			

Representative high-quality sites include Bankhead National Forest (Winston County), Monte Sano State Park (Madison County), Little River Canyon National Preserve (DeKalb and Cherokee counties).

### Condition

These diverse habitats have not received significant study in Alabama, so condition is poorly known. Although some have been impacted by quarrying, impoundments, and development, many remain in good condition due to the ruggedness of the terrain and lack of suitability for agriculture or logging. Some areas (Little River Canyon in De Kalb County is one example) are beginning to receive “brow development” pressure, with home sites being placed at the top of cliffs for maximum view. Because of the limited natural disturbance and the fragility of soil and vegetation, human disturbance by trampling edges and by climbing may be particularly destructive.

### Problems Affecting Species/Habitat

- Quarrying of bedrock from cliff faces [CA1]
- Impacts to cliffs from recreational climbers [CA3, CA4]
- Impacts to cliff edges from hikers [CA3, CA4]
- Impacts from home construction at tops of escarpments [CA1, CA2]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for most GCN species [R1 – R4]
- Habitat loss and fragmentation due to development [CA1, CA2, CA3]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d).

- R1. **Rafinesque's Big-eared Bat** – Survey rockhouses for this species, determining degree of importance as roosting/feeding habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; identify habitat requirements for GCN species population; inclusion in and/or

- expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Allegheny Woodrat** – Survey bluff habitats for this species to better determine status and distribution in Alabama. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
  - R3. **Green salamander** – Surveys of Etowah, Blount, Cullman, Morgan, Limestone, Lauderdale, and Franklin counties are needed to gaps in known distribution for this species. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
  - R4. Develop better maps of the distribution of cliffs, steep outcrops, and rockhouses. A full inventory, classification, and mapping of these habitats should be undertaken as a high priority. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this key habitat; data to complete or expand GIS coverages for this key habitat.

#### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

- CA1. Protect best examples of this habitat (or of lands containing significant examples of this habitat) through acquisition or easement. Work with **USFWS**, **TNC** and other land conservation partners to identify, conserve and restore such tracts. *Performance measures*: Acres restored, enhanced, and/or protected by fee-simple or easements.
- CA2. Discourage residential development of bluff lines. Work with **local governments** to promote restrictive zoning, or to purchase scenic easements, as has been done in other parts of the country. *Performance measures*: Acres restored, enhanced, and/or protected by easements or restrictive zoning; number of regulatory protections implemented to restrict residential development.
- CA3. Support full implementation of the **USFS** Revised Management Plan, **PIF** bird conservation plans, and all applicable **USFWS** species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of partnerships and/or joint projects with **USFS**, **PIF**, **USFWS**, and others to fund and/or implement conservation projects for mutually identified species, habitats or needs.

#### High Priority Conservation Actions Needed and Key Partnership Opportunities

- CA4. Discourage careless destruction of cliff vegetation by recreational users. Work with **USFS**, **NPS**, and other land managing partners to educate the public of the fragility and significance of these habitats. *Performance measures*: Completion of an outreach plan; outreach products produced (e.g., website, frequent website updates, periodic workshops and symposia and resulting publications, maps and information packets).

### **Priority Areas for Conservation Action**

- Bankhead/Warrior Mountains
- Bear Creek System
- Black Warrior River Bluffs
- Buttahatchee River Slopes
- Cane Creek/Little Mountain
- Dugger/Talladega Mountains
- Foxtrap Creek
- Franklin/Marion/Jackson Mountains
- Huntsville Mountains
- Little River Canyon
- Lookout and Pigeon Mountains
- Lower Alabama River Bluffs and Swamps
- Natural Bridge
- Newsome Sinks
- Nickajack Cove
- North Fork Creek Glade
- Skirum Bluff
- Talladega Mountains
- Tallahatta Bluffs
- Upper Gurley Creek
- Wheeler NWR / Redstone Arsenal



## **Sources of Information for Terrestrial Habitats**

ADCNR STATE LANDS DIVISION NATURAL HERITAGE SECTION. **Alabama's natural heritage plan** – in preparation.

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- MOBILE BAY NATIONAL ESTUARINE PRESERVE. 2001. **Comprehensive conservation and management plan, Mobile Bay National Estuary Program.**
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## **Statewide Conservation Actions--Rivers and Streams**

### **Aquatic GCN Species**

Alabama is home to an unprecedented diversity of aquatic wildlife. Relative to the North American fauna, Alabama harbors 60 percent of all mussel species, 52 percent of all freshwater turtles, 43 percent of all gill-breathing snails, 38 percent of all freshwater fishes and 20 percent of all crayfishes (Lydeard and Mayden 1995, Schuster and Taylor 2004). Overall, Alabama's aquatic biodiversity is probably greater than any area of comparable size worldwide. This gives the state a central role in the conservation of this North American aquatic fauna.

Unfortunately, Alabama also leads the nation in the extinction of aquatic species. Most of these extinctions are associated with the construction of major navigation and hydroelectric dams in the 20th century. Most major Alabama rivers (Tennessee, Coosa, Tallapoosa, Alabama, Black Warrior and Tombigbee) are impounded, resulting in loss and fragmentation of riverine habitat and a high incidence of GCN species. Many of these species were formerly widespread but now have highly restricted distributions. More than 30 species of mussels, snails and fishes are currently extirpated from the state.

Presented below are overarching conservation actions to benefit Alabama's rivers and streams and more specific management needs and conservation actions for aquatic GCN species, presented by river basin. The basins are listed based on number of GCN species, beginning with the Tennessee River basin, which harbors about one-third of all Alabama GCN species (aquatic and terrestrial combined).

Of particular note to the conservation of aquatic GCN species is the development of the Alabama Aquatic Resource Culture and Restoration Center. This facility is currently being developed and staffed utilizing a major commitment of Alabama's SWG funds. Upon completion, it will serve as a regional center for the propagation and restoration of aquatic GCN species and greatly expand staff expertise within the DWFF.

**S24. Protect remaining free-flowing rivers and streams from impoundment.** Impoundments have damaging impacts on mussels, snails, crayfishes, fishes, and aquatic herpetofauna because they change lotic waters to lentic waters and most GCN species cannot tolerate this change in environment. Existing impoundments are the primary cause of aquatic species imperilment in Alabama. Remaining free-flowing river reaches (particularly on the Tennessee and Coosa Rivers) are essential to the restoration of a high number of GCN species. This action will minimize the statewide impacts of habitat loss, fragmentation and degradation resulting from impoundments.

**S25. Minimize activities that alter flow or temperature regimes in large streams and rivers.** Discharges from dams should coincide with the hydrologic cycle to the greatest extent feasible. Natural flows should be maintained to mimic seasonal flow, temperature and dissolved oxygen regimes. Water withdrawals and inter-basin transfer should be minimized. The threat of



loss of natural community integrity will be minimized by maintaining appropriate flows and temperature regimes.

**S26. Operate existing dams and other water use facilities to minimize direct impacts to aquatic fauna.** Dams fragment habitat and create a direct barrier to the movement of aquatic species. Hydroelectric dams and other water use facilities are directly responsible for fish mortality by impingement and entrainment.

**S27. Exclude point-source (industrial, municipal, agricultural) and nonpoint-source (residential, silvicultural, agricultural) pollution from waterways.** Point source pollution can directly kill, or adversely impact, food chains of aquatic fauna. For nonpoint source pollution, meet or exceed forestry and agricultural best management practices and recommendations for width of streamside management zones. Identification and quantification of sediment sources will facilitate focused mitigation actions.

**S28. Avoid the introduction of non-native aquatic species.** Introduced non-native species are a major threat to many aquatic GCN species. Non-native species should be prohibited from importation to Alabama, except under specific circumstances.

**S29. Allow natural movement of sand and gravel: retain sand and gravel bar-related processes by avoiding in-stream mineral extraction, vehicular traffic, and other disruptions to streambeds.** Disruptions to streambed integrity may cause major changes in river health downstream and upstream. Head-cutting, down-cutting, and valley plugs alter water quality, hydrologic regimes, and may even damage adjacent floodplain forests. Improper placement of culverts can cause pooling upstream and scouring downstream. Mineral extraction and vehicular traffic are not excluded from most Alabama streams. The natural movement of sand and gravel will maintain natural community integrity and minimize habitat disturbance.

**S30. Allow the natural development and movement of woody and rocky structure. Avoid desnagging.** Keep snag removal activities to the minimum necessary for boat traffic. As natural components of a river's flow regime, woody and rocky structure provides important shelters, basking sites, and other microhabitats for aquatic fauna. Retaining woody and rocky structure prevents the loss of natural community integrity and also retains the channel roughness characteristics that formed the stream channel. Significant changes in channel roughness may induce undesirable changes in stream channel stability as well as changes in stream biota.

**S31. Allow, or where impaired, restore the unimpeded development of native streambank vegetational composition and structure.** As the bank's physical structure changes in response to stream fluctuation, natural succession of native vegetation should be permitted. Limit livestock watering activities and/or develop alternative watering sites. Heavily eroded, unnaturally steep stream banks can prevent herpetofauna from migrating to adjacent upland habitats. This problem is of particular concern for nesting turtles. Maintaining native streambank vegetational composition and structure minimizes the threat of natural community integrity loss and limiting livestock watering minimizes streambank habitat disturbance.

**S32. Allow, or where impaired, restore the unimpeded development of natural processes such as bank dynamics, channel meanders, and flood regimes.** Periodic flooding revitalizes

floodplains, deposits new sediments, and prevents the river channel from down-cutting. The ecological health and natural community integrity of associated swamp and bottomland forests requires natural flood regimes.

**S33. Minimize use of fertilizers, herbicides, and pesticides near rivers.** Such pollutants can poison mollusks, fishes, and aquatic herpetofauna. Minimizing their use near aquatic habitats will reduce the threats of non-point source pollution and contamination.

**S34. Limit excessive harvest and indiscriminant killing of amphibian and reptile species.** Shooting basking turtles and snakes for sport remains a persistent problem throughout much of the Southeast. These species should all be protected by statute. Incidental take of alligator snapping turtles during otherwise legal turtle harvest operations has been documented in some areas. These practices are believed to be widespread and may be contributing to the decline of protected species. This action will increase conservation-related education and outreach about biologically significant areas and species, reducing the threat of their direct exploitation.

**S35. Dispose of dredge spoil to benefit nesting turtles.** Although dredging degrades habitat quality for some species, spoil piles that are high in sand content can serve as important turtle nesting habitat if deposited above the high-water mark along the shore, or as created islands. The appropriate use of dredge spoil may address the threat of habitat loss by restoring beach and dune habitats.

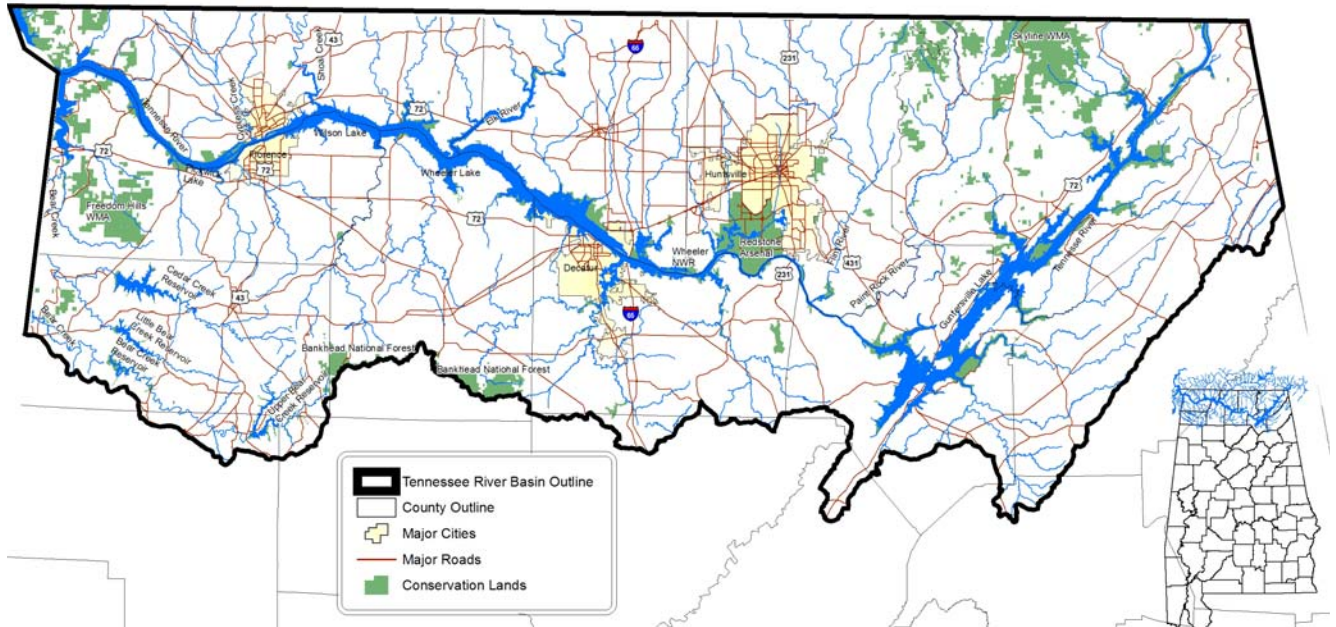
**S36. Provide conservation-related educational materials to boaters, fishermen, and other recreational users of Alabama's rivers and streams.** This action will increase conservation-related education and outreach about biologically significant areas and species, reducing the threat of direct exploitation.

### ***Conservation Actions for Specific River Basins of Alabama***

The river basins of Alabama are generally characterized based on three drainage groups. The Tennessee River basin drains more than 40,000 square miles, including portions of seven states. In Alabama, it drains all or parts of 15 northern counties, encompassing 13 percent of the state. The Mobile basin also drains an area greater than 40,000 square miles but most of the drainage is within Alabama, making it the state's principal drainage (63 percent of the state). To facilitate conservation planning, the Mobile basin is presented below based on seven sub-basins. The remaining coastal rivers (Chattahoochee, Choctawhatchee, Yellow, Blackwater, Conecuh, Perdido and Escatawpa) drain independently to the Gulf of Mexico. Jointly, these coastal rivers drain 24 percent of the state.

Presented below are overviews of Alabama's 15 river basins, including lists of GCN species, their primary research and monitoring needs, priority conservation actions to benefit GCN species and their habitats, and additional sources of information. The basins are listed based on number of GCN species, beginning with the Tennessee River basin. All freshwater aquatic GCN species are included, except cave dwellers, which are included in the terrestrial habitats.

## Tennessee River Basin



Swan Creek, Lauderdale County

Malcolm Pierson

### Description and Location

The Tennessee River Basin encompasses portions of seven states consisting of more than 40,000 square miles. In Alabama, the basin drains 6,826 square miles of 15 northern counties and is largely confined to the Southwestern Appalachians and Interior Plateau. Construction of the Tennessee-Tombigbee Waterway created a link between these two basins, allowing barges to pass from the Tennessee River, through the Tombigbee to the Gulf of Mexico at Mobile Bay.

## Chapter 4: Conservation Actions

**TABLE 4-16. GCN SPECIES, TENNESSEE RIVER BASIN**

**101 GCN SPECIES** include 48 mussels, 15 snails, 6 crayfishes, 30 fishes, 1 amphibian and 1 reptile.

<b>MUSSELS (48)</b>		Round Pigtoe	P1	<b>FISHES (30)</b>	
Pheasantshell	EX	Slabside Pearlymussel	P1	Lake Sturgeon*	EXCAU
Elktoe	EX	Kidneyshell	P1	Shovelnose Sturgeon	EX
Yellow Blossom	EX	Rabbitsfoot	P1	Shortnose Gar	EX
Catspaw	EX	Creeper	P1	Goldeye	EX
Scaleshell	EX	Pale Lilliput	P1	Spotfin Chub	EX
Hickorynut	EX	Deertoe	P1	Popeye Shiner	EX
Littlewing Pearlymussel	EX	Flutedshell	P2	Elegant Madtom	EX
Clubshell	EX	Tennessee Heelsplitter	P2	Ashy Darter	EX
Fluted Kidneyshell	EX	Black Sandshell	P2	Palezone Shiner	P1
Cumberland Monkeyface	EX	Tennessee Pigtoe	P2	Spring Pigmy Sunfish	P1
Rayed Bean	EX			Slackwater Darter	P1
Cumberland Bean	EX	<b>SNAILS (15)</b>		Lollypop Darter	P1
Dromedary Pearlymussel	EXCAU	Smooth Mudalia	EX	Boulder Darter	P1
Oyster Mussel	EXCAU	Knobby Rocksnail	EX	Blotchside Logperch	P1
Birdwing Pearlymussel	EXCAU	Spiny Riversnail	EXCAU	Slenderhead Darter	P1
Spectaclecase	P1	Slender Campeloma	P1	Snail Darter	P1
Mucket	P1	Anthony's Riversnail	P1	Alabama Shad*	P2
Slippershell Mussel	P1	Round-rib Elimia	P1	Streamline Chub	P2
Fanshell	P1	Engraved Elimia	P1	Shoal Chub	P2
Spike	P1	Corpulent Hornsnail	P1	Ghost Shiner	P2
Cumberlandian Combshell	P1	Armored Marstonia	P1	Suckermouth Minnow	P2
Snuffbox	P1	Moss Pyrg	P1	Stargazing Minnow	P2
Shiny Pigtoe	P1	Armored Rocksnail	P2	Mountain Madtom	P2
Finerayed Pigtoe	P1	Warty Rocksnail	P2	Brindled Madtom	P2
Longsolid	P1	Muddy Rocksnail	P2	Highlands Stonecat	P2
Cracking Pearlymussel	P1	Rugged Hornsnail	P2	Bluebreast Darter	P2
Pink Mucket	P1	Skirted Hornsnail	P2	Tuscumbia Darter	P2
Alabama Lampmussel	P1			Bandfin Darter	P2
Cumberland Moccasinsell	P1	<b>CRAYFISHES (6)</b>		Blueface Darter	P2
Ring Pink	P1	<i>Cambarus halli</i>	P2	Gilt Darter	P2
Round Hickorynut	P1	<i>Cambarus cracens</i>	P2		
White Wartyback	P1	<i>Cambarus unestami</i>	P2	<b>AMPHIBIANS (1)</b>	
Orangefoot Pimpleback	P1	<i>Orconectes alabamensis</i>	P2	Eastern Hellbender	P1
Sheepnose	P1	<i>Orconectes cooperi</i>	P2		
Tennessee Clubshell	P1	<i>Orconectes mississippiensis</i>	P2	<b>REPTILES (1)</b>	
Rough Pigtoe	P1			Alligator Snapping Turtle	P2
Pyramid Pigtoe	P1				

EX: Extirpated – No longer known to occur in Alabama. EXCAU: Extirpated but currently being reintroduced to Alabama

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from the Alabama portion of this river basin but still occur in other Alabama river basins.

The Nature Conservancy considers the Tennessee River basin to be the most biologically diverse river basin in North America. Boschung and Mayden (2004) list 163 fish species for the Alabama portion of the Tennessee basin, 73 of which do not occur in other Alabama drainages. A total of 90 species of freshwater mussels and 66 species of aquatic snails are known from

Alabama reaches of the Tennessee River basin. Of those, 73 mussels and 51 snails occur in no other Alabama drainages.

### Condition

Impoundment of the Tennessee River and degradation of tributary streams has had a major impact on the aquatic fauna. This list of 102 GCN species constitutes about one-third of all GCN species (terrestrial and aquatic combined) identified for Alabama. Conservation of this fauna will require enhanced water quality in all major tributary streams and remaining large river habitat, particularly the tailwaters of Wilson and Guntersville Dams.

The 2002 ADEM 303(d) list identifies 63 stream segments, comprising 650 miles in the Tennessee River basin with impaired water quality as partially or not supporting designated uses. This is a far greater mileage of impaired streams than in any other river basin in Alabama, accounting for about one-third of the statewide total, even though the Tennessee basin covers only 13 percent of Alabama. Most impairment is caused by organic enrichment, siltation and pathogens and is of agricultural origin. The Tennessee River basin includes the highest proportion agricultural lands (and lowest proportion of forested lands) of any river basin in Alabama.

**Major Impoundments** – four on mainstem in Alabama; Guntersville (69,100 acres), Wheeler (68,300 acres), Wilson (15,930 acres) and Pickwick (41,515 acres); four in Bear Creek sub-basin; Bear (670 acres), Little Bear (1,560 acres), Upper Bear (1,850 acres) and Cedar Creek (4,200 acres)

**Land Use** – 49% forested, 41% agriculture and pasture, 5% urban

### Problems Affecting Species/Habitat

- Impoundments on the Tennessee River, Elk River and in the Bear Creek watershed are responsible for loss of most riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA3, CA4, CA5, CA6, CA8, CA9]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA1, CA2, CA3]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R20]
- Introduction of, failure to eradicate or control non-native crayfish, zebra mussels, and Asiatic clams. [CA7]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life

history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R2. **Birdwing Pearlymussel, Dromedary Pearlymussel, Oyster Mussel** – Tennessee basin endemics, extirpated from Alabama portion of the basin. In 2001, USFWS approved these species for inclusion in a Nonessential Experimental Population below Wilson Dam. In 2003, 80 birdwing pearlymussels and 80 oyster mussels were transplanted from the Duck River, Tennessee, and 80 dromedary pearlymussels were transplanted from the Clinch River, Tennessee. Monitor transplants to determine if further augmentation and/or reintroduction of these and other species is warranted. *Product(s)*: Assessment of the status and/or condition of transplanted mussels; identification of needed conservation actions including additional population augmentation and/or reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Cumberland Monkeyface, Catspaw, Clubshell, Cumberland Bean, Yellow Blossom** – Extirpated from Alabama portion of Tennessee basin. Approved for Wilson Dam Nonessential Experimental Population. Basic life history studies are needed to determine if appropriate habitat and glochidial hosts exist in Wilson Dam tailwaters. If warranted, a captive propagation program will be necessary using parent stock from the nearest source. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of these GCN mussels; identification and mapping of remaining habitats and identification of potential glochidial hosts in Wilson Dam tailwaters; assessment of need for a captive propagation program, and if so, establishment of such a program.
- R4. **Alabama Lampmussel, Cumberland Combshell, Cracking Pearlymussel, Shiny Pigtoe, and Finerayed Pigtoe** – In Alabama, extant at only one location in Tennessee basin. Approved for Wilson Dam Nonessential Experimental Population. Basic life history studies are needed to determine if appropriate habitat and glochidial hosts exist in Wilson Dam tailwaters. If warranted, a captive propagation program will be necessary. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of these GCN mussels; identification and mapping of remaining habitats and identification of glochidial hosts in Wilson Dam tailwaters; assessment of need for a captive propagation program, and if so, establishment of such a program.
- R5. **Elktoe, Fluted Kidneyshell, Hickorynut, Littlewing Pearlymussel, Pheasantshell, Scaleshell Mussel, Rayed Bean** – Extirpated from Alabama portion of Tennessee basin. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s)*: Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R6. **Tennessee Heelsplitter** – Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of Tennessee heelsplitter, allowing identification of needed conservation actions; a



population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R7. **Remaining 28 GCN Species** – Extant in the Alabama portion of the Tennessee basin in less than five known locations. Conduct a comprehensive inventory of each species, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; population viability analyses; identification and GIS mapping of key habitats for possible reintroductions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Snails

- R8. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R9. **Spiny Riversnail** – Tennessee basin endemic, extirpated from Alabama portion of the basin. Recently reintroduced into tailwaters of Nickajack Dam. If successful, this introduction should result in colonization of the Alabama reach of upper Guntersville Reservoir. Monitor transplants to determine if further augmentation and/or reintroduction is warranted, including possible reintroduction to Wilson and Guntersville Dam tailwaters. *Product(s)*: Assessment of the status and/or condition of transplanted snails; identification of needed conservation actions including additional population augmentation and/or reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R10. **Knobby Rocksnail** – Tennessee basin endemic, extirpated from Alabama portion of the basin. Initiate a captive rearing program using Kentucky Dam tailwater stock to produce juveniles for reintroduction into Wilson Dam tailwaters and Shoal Creek. *Product(s)*: Establishment of captive rearing program; number of snails produced and reintroduced into Wilson Dam tailwaters and Shoal Creek.
- R11. **Anthony's Riversnail** – Extant at only two locations in Alabama portion of Tennessee basin. Approved for Wilson Dam Nonessential Experimental Population and 2,370 individuals were transplanted through spring 2005. Monitor transplants to determine if further augmentation and/or reintroduction is warranted. A captive propagation program may be necessary. *Product(s)*: Assessment of the status and/or condition of transplanted snails; identification of needed conservation actions including additional population augmentation and/or reintroduction and a captive propagation program; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R12. **Corpulent Hornsnail, Moss Pyrg, Engraved Elimia, Round-rib Elimia, Slender Campeloma, Rugged Hornsnail, Skirted Hornsnail, Armored Rocksnail, Muddy Rocksnail, Warty Rocksnail** – Extant less than five locations in Alabama portion of

Tennessee basin. Conduct a comprehensive inventory, including evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN snails; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.

- R13. **Corpulent Hornsnail, Engraved Elimia, Warty Rocksnail, Round-rib Elimia, Skirted Hornsnail, Muddy Rocksnail, Warty Rocksnail** – Clarify taxonomic status relative to similar species using morphological and genetic analyses. *Product(s)*: Clarified taxonomic status of these GCN snails.

#### Crayfishes

- R14. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and investigate life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Fishes

- R15. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R16. **Ashy Darter, Elegant Madtom** – Extirpated from Alabama portion of Tennessee basin. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s)*: Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R17. **Blotchside Logperch, Palezone Shiner, Boulder Darter, Lollipop Darter, Snail Darter, Bluebreast Darter** – Extant in the Alabama portion of the Tennessee basin at only one known location. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN fish, allowing identification of needed conservation actions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R18. **Slackwater Darter, Slenderhead Darter, Bandfin Darter, Blueface Darter, Gilt Darter** – Extant in the Alabama portion of the Tennessee basin at few known locations. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN fish, allowing identification of needed conservation actions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion

in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R19. **Blueface Darter, Tuscumbia Darter** – Determine systematic relationships among populations using morphological and genetic analyses. *Product(s)*: Determination of systematic relationships between blueface and Tuscumbia darters; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions and identify needed conservation actions.

#### Amphibians

- R20. **Eastern Hellbender** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN amphibians, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Tennessee Rivers Basin Management Plan, including all existing Tennessee drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of Management Plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **TVA** at Tennessee River, Elk River and Bear Creek watershed dams. In particular, the tailwaters of Wilson and Guntersville Dams are critical to the recovery of more GCN species than any other sites in Alabama. *Performance measures*: Number of dams operated with more natural flow regimes; **ADEM** water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **TVA, ADEM, local governments, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA4. Support expansion of the **Wheeler National Wildlife Refuge** to include lower reaches of Limestone and Piney creeks, by working with the **USFWS, Forever Wild, TNC and other partners**. *Performance measures*: Acres and stream miles added to the refuge and/or protected by fee-simple or easements.

**High Priority Conservation Actions Needed and Key Partnership Opportunities****Mussels**

- CA5. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The most critical sites for the conservation of mussels in the Tennessee basin are the tailwaters of Wilson and Guntersville Dams, the Paint Rock River and Bear Creek. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN mussels in the river basin; number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Snails**

- CA6. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The most critical sites for the conservation of snails in the basin are the tailwaters of the Tennessee River Dams. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN snails in the river basin; if necessary, number of snails reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Crayfishes**

- CA7. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

**Fishes**

- CA8. **Ashy Darter, Elegant Madtom, Blotchside Logperch, Palezone Shiner, Boulder Darter, Lollipop Darter, Snail Darter, Bluebreast Darter, Slackwater Darter, Slenderhead Darter, Bandfin Darter, Blueface Darter, Gilt Darter** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN fish in the river basin; if necessary, number of fish reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.
- CA9. **Boulder Darter** – The Elk River from Gallus Island upstream to the Tennessee-Alabama state line should be designated as critical habitat for this endangered species. This designation would also assist the recovery of other Elk River GCN species. *Performance measure:* Designation of such critical habitat.

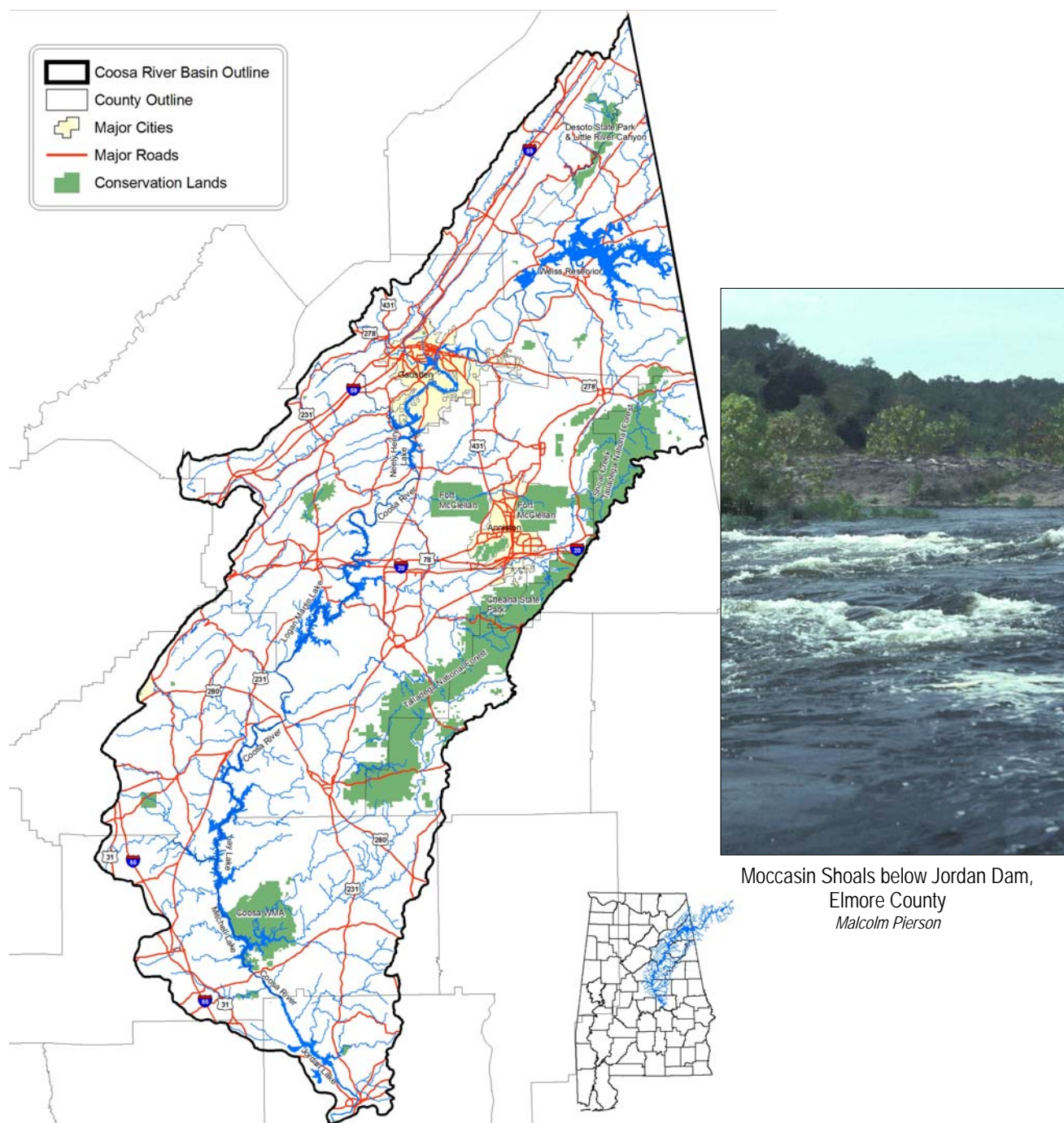
**Priority Areas for Conservation Action**

- Beaverdam Creek
- Cypress Creek
- Flint River
- Indian Creek / Kelly Spring
- Limestone Creek
- Paint Rock River (and tributaries including Estill Fork, Larkin Fork, Hurricane Creek)
- Piney Creek
- Shoal / Butler Creeks
- Swan Creek / Florence Cave Complex

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- Tennessee Mainstem below Guntersville
- Tennessee Mainstem top of Pickwick
- White Spring
- Bear Creek
- Elk River
- Tennessee River Mainstem above Guntersville / Sequatchie River

## Coosa River Basin



### Description and Location

The Coosa River basin originates in the Blue Ridge and Ridge and Valley ecoregions of northwest Georgia and a small portion of southeast Tennessee. The river flows southwest to join the Tallapoosa River to form the Alabama River. The Coosa River in Alabama is largely



impounded. The total drainage area is 10,161 square miles, of which 5,353 square miles are in Alabama.

**TABLE 4-17. GCN SPECIES, COOSA RIVER BASIN**

**47 GCN SPECIES** include 21 mussels, 11 snails, 3 crayfishes, 11 fishes, and 1 reptile.

<b>MUSSELS (21)</b>		Alabama Hickorynut*	P2	<i>Cambarus cracens</i>	P2
Upland Combshell	EX	Southern Clubshell	P2	<i>Cambarus scotti</i>	P2
Southern Acornshell	EX	Alabama Creekmussel	P2		
Coosa Moccasinshell	EX	Coosa Creekshell	P2	<b>FISHES (11)</b>	
Georgia Pigtoe	EX			Lake Sturgeon	EXCAU
Alabama Spike	P1	<b>SNAILS (11)</b>		Trispot Darter	EX
Delicate Spike	P1	Interrupted Rocksnail	EXCAU	Southern Combshell*	P1
Southern Pigtoe	P1	Cylindrical Lioplax*	P1	Alabama Sturgeon*	P1
Heavy Pigtoe*	P1	Tulotoma	P1	Pygmy Sculpin	P1
Pleurobema sp.	P1	Lacy Elimia	P1	Holiday Darter	P1
Rayed Kidneyshell	P1	Teardrop Elimia	P1	Goldline Darter*	P1
Southern Purple Lilliput	P1	Cobble Elimia	P1	Alabama Shad*	P2
Rayed Creekshell	P2	Gulf Sturgeon*	P2	Blue Shiner	P2
Finelined Pocketbook	P2	Rough Hornsnail	P1	Coldwater Darter	P2
Etowah Heelsplitter	P2	Flat Pebblesnail*	P1	Coal Darter	P2
Black Sandshell*	P2	Round Rocksnail	P2	<b>REPTILES (1)</b>	
Alabama Moccasinshell	P2	Spotted Rocksnail*	P2	Alligator Snapping Turtle	P2
		Painted Rocksnail	P2		
		<b>CRAYFISHES (3)</b>			
		<i>Cambarus halli</i>	P2		

EX: Extirpated – No longer known to occur in Alabama. ExCAU: Extirpated but currently being reintroduced to Alabama

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from the Alabama portion of this river basin but still occur in other Alabama river basins.

The Coosa Watershed is the largest and most biologically diverse subwatershed of the Mobile River basin in terms of overall number of fishes, mussels and aquatic snails.

### Condition

Three hydroelectric dams were constructed by APC on the lower river between 1916 and 1928, followed by three dams in the 1960's that extended impoundment upstream to the Georgia line. Remaining free-flowing riverine habitats are limited to short reaches below Weiss, Neely Henry, Logan Martin, Lay, Mitchell, and Jordan dams. Aquatic biodiversity has declined significantly as a result of riverine habitat loss, modification and fragmentation from impoundments, and water quality degradation. In particular, impoundment of the Coosa River resulted in the extinction of more than 40 species of mussels and snails.

Georgia lists 121 miles of streams in the Coosa basin as partially supporting their designated uses and 371 miles as not supporting their uses. Urban runoff and high PCB concentrations in fish are the most commonly cited problems. In Alabama, the 2002 ADEM 303(d) list identifies

62 miles of streams in the Coosa basin that either do not support or only partially support their designated uses. Gravel mining, feedlots, cropland erosion, and hydroelectric power production are sources for organic enrichment and low DO concentrations in the basin. Weiss, Neely Henry, Logan Martin, Lay, and Mitchell Reservoirs either do not support or only partially support their designated uses. Priority organics, nutrients, pH, organic enrichment, DO, and flow alteration are listed as some of the causes for the impairment. Sources of these impairments range from flow regulation to industrial discharges to urban and rural non-point source pollution.

**Major Impoundments** – Six dams on mainstem in Alabama; Weiss (30,200 acres), Neely Henry (11,235 acres), Logan Martin (15,260 acres), Lay (12,000 acres), Mitchell (5,850 acres) and Jordan (6,800 acres).

**Land Use** – 70% forested, 19% agriculture and pasture, 5% urban.

### Problems Affecting Species/Habitat

- Impoundment of the Coosa River is responsible for loss of most riverine habitat, fragmentation and isolation of streams, and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA3, CA4, CA5, CA6, CA8, CA9, CA10, CA11]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture, mining, and urbanization of the watershed. [CA1, CA2, CA3]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R20]
- Introduction of, failure to eradicate or control non-native crayfish. [CA7]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Upland Combshell, Southern Acornshell** – Possibly extinct. Conduct a survey to determine if the species are extant. If found, initiate a captive rearing program to produce juveniles for reintroduction into suitable habitat. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN mussels; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of mussels propagated and reintroduced.

- R3. **Georgia Pigtoe** – Coosa River endemic. Apparently only extant in Georgia headwaters. Conduct a comprehensive inventory, including evaluation of population viability and identification of potential reintroduction sites. Basic life history information, including identification of glochidial hosts, is lacking. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Georgia pigtoe; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Coosa Moccasinshell, Alabama Moccasinshell, Black Sandshell** – Extirpated from Coosa drainage, except for Georgia and Tennessee headwaters. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s)*: Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R5. **Rayed Creekshell, Heavy Pigtoe, Alabama Hickorynut, Delicate Spike** – Possibly extirpated from Coosa drainage. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN mussels; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.
- R6. **Southern Combshell** – Extirpated from Coosa drainage but remains extant in Buttahatchee River in Tombigbee Basin. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. Basic life history information, including identification of glochidial hosts, is lacking. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of Southern combshell; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts.
- R7. **Southern Clubshell** – Closely monitor populations in Big Canoe Creek and Weiss Lake bypass, which is probably the last remaining functional population of this species in a large-river habitat. Evaluate large Coosa and Tallapoosa tributaries as possible reintroduction sites. *Product(s)*: Data to fill information gaps to assess the status and/or condition of this GCN species; identification and GIS mapping of key habitats in large Coosa and Tallapoosa tributaries for possible reintroduction.
- R8. **Etowah Heelsplitter** – Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of Etowah heelsplitter, allowing identification of needed conservation actions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R9. **Alabama Spike, Rayed Kidneyshell, Finelined Pocketbook** – Determine systematic relationships among populations from different parts of the Mobile Basin using morphological and genetic analyses. Conduct comprehensive inventories, evaluate population viability and identify potential reintroduction sites. *Product(s)*:

Determination of systematic relationships between these populations in the river basin; data to fill information gaps for mapping abundance and distribution of these GCN mussels; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.

### Snails

- R10. **All GCN Species** should be comprehensively surveyed at 2 to 5 year intervals. Determine life history requirements, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R11. **Teardrop Elimia, Cobble Elimia** – Believed extinct until rediscovered by J. Garner in Logan Martin tailrace in summer 2004. Conduct comprehensive inventories, with emphasis on Coosa Dam tailwaters, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of Teardrop Elimia and Cobble Elimia; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.
- R12. **Interrupted Rocksnail** – Believed extinct until rediscovered by J. Williams in the Oostanaula River in Georgia in 1997(DCNR 2003). Reintroduced to Jordan Dam tailwaters, beginning in fall 2003. Continue evaluation of introduced population and identify additional reintroduction sites. Support captive propagation program for this species, using propagated individuals to augment the reintroduced population in Jordan Dam tailwaters. *Product(s)*: Assessment of the status and/or condition of introduced snails; identification of needed conservation actions including additional population augmentation and reintroduction sites; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R13. **Cylindrical Lioplax, Flat Pebblesnail** – Apparently extirpated from Coosa drainage. Initiate a captive rearing program using Cahaba River stock to produce juveniles for reintroduction into suitable Coosa drainage habitat. *Product(s)*: Identification and GIS mapping of key habitats for possible reintroduction; establishment of a captive propagation program; number of snails propagated and reintroduced.
- R14. **Spotted Rocksnail** – Possibly extirpated from Coosa drainage but extant in Alabama River. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. If Alabama River populations are found suitable to support transplants, move individuals to appropriate sites; if Alabama River populations are found to be unsuitable for supporting transplants, initiate a captive propagation program. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.

### Crayfishes

- R15. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement long-term quantitative monitoring protocol. Initiate research into captive holding and propagation of crayfish. *Product(s) / Performance measure(s)*:

Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R16. **All GCN Species** – should be comprehensively surveyed at 3 to 5 year intervals, and life history requirements determined. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R17. **Trispot Darter** – Coosa River endemic. Currently only extant in Georgia and Tennessee headwaters. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.
- R18. **Holiday Darter** – Coosa River endemic. Conduct a comprehensive inventory of springs and spring-fed streams in Shoal Creek and the upper Choccolocco Creek basin, evaluate population viability and identify potential reintroduction sites. These populations are genetically distinct from populations in the Georgia portion of the Coosa basin. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.
- R19. **Coldwater Darter** – Determine systematic relationships between stream and spring forms using morphological and genetic analyses. Survey streams in Coosa and Talladega counties to identify additional populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; determination of systematic relationships between stream and spring forms.
- R20. **Pygmy Sculpin** – Population limited to Coldwater Spring and spring run, Calhoun County. Additional springs for possible introduction need to be identified, but a careful assessment of potential adverse impacts on endemic invertebrates of recipient sites should be made before moving sculpins. Establishment of a captive population is needed to insure survival of the species. *Product(s)*: Identification and GIS mapping of key habitats for possible reintroduction; establishment of a captive propagation program; number of pygmy sculpin propagated and reintroduced.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Lower, Middle, and Upper Coosa River Basins Management Plans and the Mobile Basin Recovery Plan, including all existing Coosa drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: number of management and recovery plan needs or

projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.

- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **APC** at Coosa River dams. Ongoing continuous flows from Jordan Dam and initiation of continuous flows from Weiss Dam will be critical to the recovery of more than 20 species of Coosa basin mussels and snails. *Performance measures:* Number of dams operated with more natural flow regimes; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, local governments, Coosa River Basin Initiative, Coosa River Society, Clean Water Partnership and other partners.** *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; **ADEM** water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA4. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners.** *Performance measures:* Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.
- CA5. **Southern Clubshell** – Provision of continuous flows from Weiss Dam by **APC** would greatly improve habitat conditions for what is probably the last remaining functional large-river population of this species. *Performance measure:* Establishment of continuous flows from Weiss Dam.

#### Snails

- CA6. **All GCN Species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability, beginning with the interrupted rocksnail, which has already been reintroduced to the Jordan Dam tailrace. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners.** Provision of continuous flows from Weiss Dam and improvement of the physical habitat by **APC** would create a high quality reintroduction site for these species. *Performance measures:* Population status and condition of GCN snails in the river basin; number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements; establishment of continuous flows from Weiss Dam.

#### Crayfishes

- CA7. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and



condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

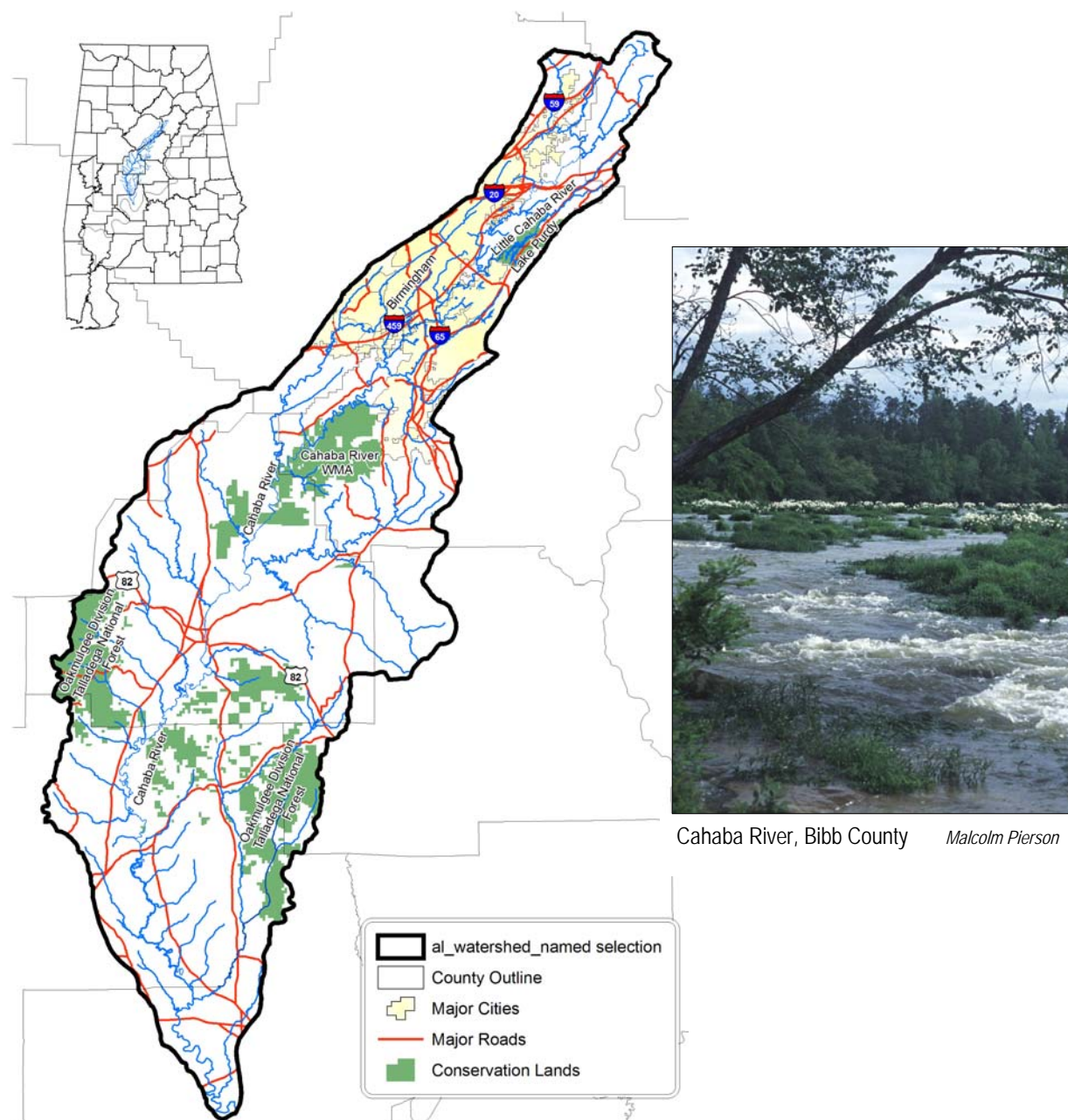
### Fishes

- CA8. **Gulf Sturgeon, Alabama Shad** – Fish passage should be provided by **COE** at Alabama River dams to provide access to historic habitat in the Alabama, Cahaba, Coosa and Tallapoosa Rivers. *Performance measure:* Number of fish passages installed at dams on the Alabama River.
- CA9. **Blue Shiner, Trispot Darter, Holiday Darter** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN fish in the river basin; if necessary, number of fish reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.
- CA10. **Coldwater Darter** – Habitat protection, targeting conservation easements are needed for most of the springs supporting extant populations of this species. *Performance measures:* Acres of spring habitat restored, enhanced, and/or protected by fee-simple or easements.
- CA11. **Pygmy Sculpin** – Establishment of a captive population and introduction to additional springs is needed to insure survival of the species. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Establishment of captive population; number of pygmy sculpin propagated and introduced to springs.

### Priority Areas for Conservation Action

- |                                                       |                                            |
|-------------------------------------------------------|--------------------------------------------|
| • Big Canoe Creek                                     | • Kelley / Yellowleaf / Waxahatchee Creeks |
| • Calhoun County Springs (including Coldwater Spring) | • Little River                             |
| • Cedar Creek                                         | • Little Wills Creek                       |
| • Chestnut Creek                                      | • Lower Coosa Mainstem below Jordan        |
| • Choccolocco Creek                                   | • Manitou Cave                             |
| • Colvin Mountain Springs                             | • Shoal Creek                              |
| • Coosa Mainstem below Logan Martin                   | • Sofkahatchee Creek                       |
| • Dead River                                          | • Spring Creek                             |
| • Terrapin Creek                                      | • Talladega Spring                         |
| • Duck Springs / Little Sand Valley Creek             | • Tallassee hatchee Creek                  |
| • Hatchet / Weogufka Creeks                           | • Tallassee hatchee River and Springs      |

## Cahaba River Basin



Cahaba River, Bibb County *Malcolm Pierson*

### Description and Location

The Cahaba River originates northeast of Birmingham and flows southwest through the Birmingham metropolitan area to join the Alabama River downstream of Selma. It is the longest free flowing river in Alabama and is about equally divided between the Ridge and Valley and the Southeastern Plains. The basin covers an area of 1,818 square miles and is completely within Alabama.

**TABLE 4-18. GCN SPECIES, CAHABA RIVER BASIN**

**47 GCN SPECIES** include 21 mussels, 12 snails, 2 crayfishes, 9 fishes, 1 amphibian and 2 reptiles.

**MUSSELS (21)**

Upland Combshell	EX
Coosa Moccasinshell	EX
Alabama Spike*	P1
Delicate Spike	P1
Southern Combshell*	P1
Southern Pigtoe*	P1
Ovate Clubshell	P1
Warrior Pigtoe*	P1
Heavy Pigtoe*	P1
Rayed Kidneyshell	P1
Southern Purple Lilliput	P1
Rayed Creekshell	P2
Finelined Pocketbook	P2
Etowah Heelsplitter	P2
Black Sandshell*	P2
Alabama Moccasinshell	P2
Alabama Hickorynut*	P2
Southern Clubshell	P2
Alabama Heelsplitter*	P2

**SNAILS (12)**

Alabama Creekmussel	P2
Coosa Creekshell	P2
Cahaba Pebblesnail	P1
Cylindrical Lioplax	P1
Princess Elimia	P1
Cockle Elimia	P1
Rough Hornsnail*	P1
Flat Pebblesnail	P1
Ample Elimia	P2
Lilyshoals Elimia	P2
Puzzle Elimia	P2
Squat Elimia	P2
Round Rocksnail	P2
Painted Rocksnail	P2

**CRAYFISHES (2)**

<i>Cambarus halli</i>	P2
<i>Orconectes chickasawae</i>	P2

**FISHES (9)**

Alabama Sturgeon	P1
Cahaba Shiner	P1
Goldline Darter	P1
Gulf Sturgeon*	P2
Alabama Shad	P2
Blue Shiner*	P2
Bluenose Shiner	P2
Frecklebelly Madtom	P2
Coal Darter	P2

**REPTILES (2)**

Rainbow Snake	P2
Alligator Snapping Turtle	P2

EX: Extirpated – No longer known to occur in Alabama.

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

Mayden and Kuhajda (1989) note that the Cahaba is the most ichthyologically diverse river for its size in North America. Pierson et al. (1989) report 131 fish species, including 18 Mobile Basin endemics. The Cahaba once harbored an extremely rich mussel fauna consisting of 43 species (van der Schalie 1938) but recent surveys document only 33 species (Shepard et al. 1994, McGregor et al. 2000).

### Condition

The 2002 ADEM 303(d) list identifies 185 miles of streams in the Cahaba basin with impaired water quality that either do not support or only partially support their designated uses. Most of these impairments are above the fall line and are directly related to development of the Birmingham metropolitan area. Included are more than 100 miles of the Cahaba River and 55 miles of Shades Creek.

**Major Impoundments** – None on the mainstem, Lake Purdy (1,050 acres) is in the Little Cahaba River sub-basin.

**Land Use** – 65% forested, 16% urban, 15% agriculture and pasture

### Problems Affecting Species/Habitat

- Water quality degradation, particularly sedimentation and nutrient enrichment related to urbanization of the upper watershed and agricultural and silvicultural practices is the primary threat to GCN species. [CA1, CA2, CA3, CA4, CA5, CA7]
- Migrations of some fishes are impeded by Alabama River dams. [CA8]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many GCN species. [R1 – R12]
- Introduction of, failure to eradicate or control non-native crayfish. [CA6]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Upland Combshell** – Possibly extinct. Conduct a survey to determine if species is extant. If found, initiate a captive rearing program to produce juveniles for reintroduction into suitable habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN mussels; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of mussels propagated and reintroduced.
- R3. **Delicate Spike** – The best remaining population of the Delicate Spike appears to be in the Cahaba River. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Southern Combshell, Coosa Moccasinshell, Southern Pigtoe, Warrior Pigtoe, Heavy Pigtoe, Alabama Heelsplitter, Alabama Spike** – Extirpated from Cahaba drainage. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s)*: Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R5. **Alabama Spike, Finelined Pocketbook, Rayed Kidneyshell** – Determine systematic relationships among populations from different parts of the Mobile Basin using morphological and genetic analyses. Conduct comprehensive inventories, determine life history requirements, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Determination of systematic relationships between these populations in the river basin; data to fill information gaps for mapping

abundance and distribution of these GCN mussels; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.

### Snails

- R6. **Cockle Elimia, Princess Elimia, Lilyshoals Elimia, Squat Elimia, Puzzle Elimia, Ample Elimia** – Cahaba basin endemics. Comprehensive survey at 2 to 5 year intervals, determine life history requirements, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R7. **Cylindrical Lioplax, Flat Pebblesnail, Round Rocksnail** – Extant in Cahaba basin but extirpated from other drainages. Comprehensive survey at 2 to 5 year intervals, determine life history requirements, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R8. **Rough Hornsnail** – Extirpated from Cahaba basin but remains extant in Coosa basin. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of Rough Hornsnail, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R9. **Cockle Elimia, Princess Elimia** – Each currently extant only at single locations. A survey for potential reintroduction sites is needed. Initiate a captive rearing program to produce juveniles for reintroduction into suitable Cahaba drainage habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN snails; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of snails propagated and reintroduced.

### Crayfishes

- R10. **All GCN Species** have very limited and poorly defined distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established

and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R11. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R12. **Blue Shiner** – Apparently extirpated from Cahaba drainage. Initiate a captive rearing program using Coosa drainage stock to produce juveniles for reintroduction into suitable Cahaba drainage habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; establishment of a captive propagation program; number of fish propagated and reintroduced.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Cahaba River Basin Management Plan and the Mobile Basin Recovery Plan, including all existing Cahaba drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of management and recovery plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments, Cahaba River Society, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA3. Support expansion of the Cahaba River National Wildlife Refuge to fulfill its acquisition boundaries by working with the **USFWS, Forever Wild, TNC and other partners**. *Performance measures*: Acres added to the refuge and/or protected by fee-simple or easements.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA4. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.



**Snails**

- CA5. **All GCN Species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability, beginning with the Cockle Elimia and Princess Elimia. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN snails in the river basin; if necessary, number of snails reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Crayfishes**

- CA6. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

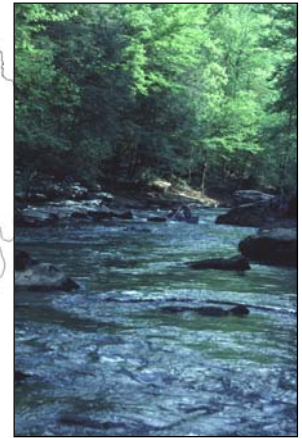
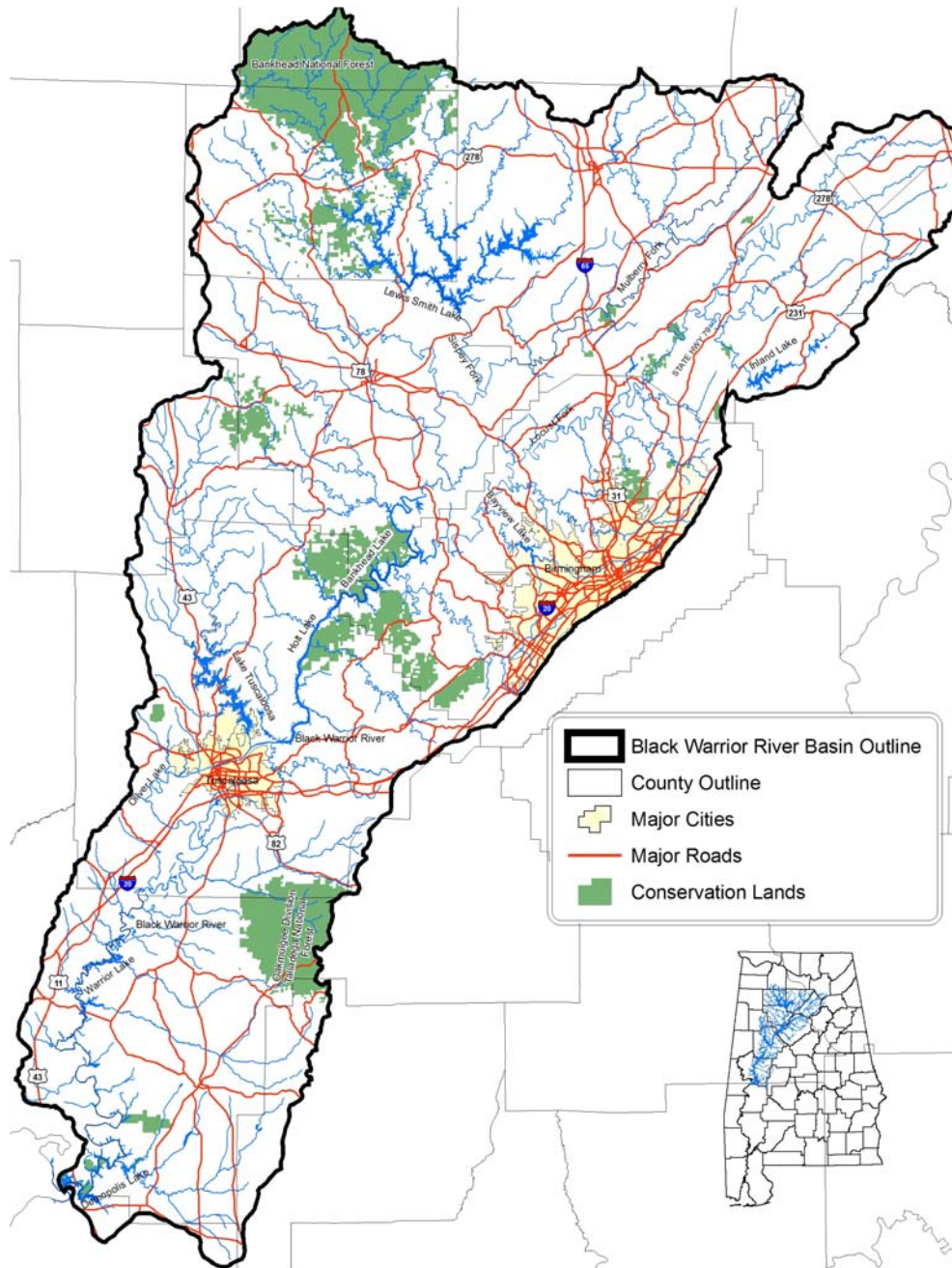
**Fishes**

- CA7. **Alabama Sturgeon, Blue Shiner, Bluenose Shiner, Cahaba Shiner, Coal Darter, Goldline Darter** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN fish in the river basin; if necessary, number of fish reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.
- CA8. **Alabama Sturgeon, Gulf Sturgeon, Alabama Shad** – Fish passage should be provided by **COE** at Alabama River dams to provide access to historic habitat in the Alabama, Cahaba, Coosa and Tallapoosa. *Performance measure:* Number of fish passages installed at dams on the Alabama River.

**Priority Areas for Conservation Action**

- Lower Cahaba River and tributaries (below Fall Line, including Blue Gurth Creek)
- Upper Cahaba River and tributaries (above Fall Line, including Schultz, Caffey and Little Schultz Creeks)
- Little Cahaba River and tributaries (including Sixmile, Mahan, Shoal, Alligator and Spring Creeks)

## Black Warrior River Basin



Sipsey Fork, Winston County  
Malcolm Pierson

### Description and Location

The Black Warrior River originates in the Southwestern Appalachians and is formed by the confluence of the Sipsey, Mulberry and Locust Forks, the major drainages of the upper basin. The river then flows south to the fall line at Tuscaloosa and through the Southeastern Plains to its confluence with the Tombigbee River at Demopolis. The basin covers an area of 6,276 square miles and is completely within Alabama.

**TABLE 4-19. GCN SPECIES, BLACK WARRIOR RIVER BASIN**

38 GCN SPECIES include 17 mussels, 3 snails, 2 crayfishes, 12 fishes, 1 amphibian and 3 reptiles.

<b>MUSSELS (17)</b>		Alabama Hickorynut*	P2	Watercress Darter	P1
Upland Combshell	EX	Southern Clubshell*	P2	Rush Darter	P1
Coosa Moccasinshell	EX	Alabama Heelsplitter	P2	Warrior Bridled Darter	P1
Alabama Spike*	P1			Gulf Sturgeon*	P2
Delicate Spike	P1	<b>SNAILS (3)</b>		Alabama Shad	P2
Southern Combshell*	P1	Cylindrical Lioplax*	P1	Locust Fork Darter	P2
Ovate Clubshell	P1	Plicate Rocksnail	P1	Sipsey Darter	P2
Warrior Pigtoe	P1	Black Mudalia	P2	Blueface Darter	P2
Heavy Pigtoe*	P1			Coal Darter	P2
Triangular Kidneyshell	P1	<b>CRAYFISHES (2)</b>			
Southern Purple Lilliput	P1	<i>Cambarus cracens</i>	P2	<b>AMPHIBIANS (1)</b>	
Rayed Creekshell	P2	<i>Orconectes mississippiensis</i>	P2	Black Warrior Waterdog	P2
Orangenacre Mucket	P2				
Black Sandshell*	P2	<b>FISHES (12)</b>		<b>REPTILES (3)</b>	
Alabama Moccasinshell	P2	Alabama Sturgeon*	P1	Rainbow Snake	P2
		Cahaba Shiner	P1	Alligator Snapping Turtle	P2
		Vermilion Darter	P1	Flattened Musk Turtle	P2

EX: Extirpated – No longer known to occur in Alabama.

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

The Black Warrior basin harbors a rich native aquatic fauna, including 119 fish species (Boschung and Mayden 2004) and 48 mussels (Williams et al. 1992).

### Condition

The Black Warrior River is impounded throughout its length and provides barge navigation as far as Birmingham. Loss of riverine habitat has isolated most GCN species to tributary streams, particularly the Sipsey and Locust Forks. A unique feature of the Black Warrior basin is the presence of extensive coal deposits. The middle portion of the basin is the largest coal producing area in southern North America. This history of mining has resulted in an unusually high

proportion of impaired streams. The 2002 ADEM 303(d) list identifies 470 miles of streams in the Black Warrior basin that either do not support or only partially support their designated uses. About half of these impairments are related to abandoned mines. Additional sources of impairment include agricultural and urban run-off. Bayview Lake is impaired due to excessive siltation. A large portion of the Birmingham metropolitan area is located within the Locust Fork watershed.

**Major Impoundments** – five on mainstem; Bankhead (9,200 acres), Holt (3,296 acres), Oliver (2,200 acres), Warrior (9,100 acres) and Demopolis (10,000 acres): two in Locust Fork sub-

basin; Bayview (554 acres) and Inland (1,536 acres): one on Sipsey Fork; Lewis Smith (21,200 acres): one on North River; Tuscaloosa (5,885 acres)

**Land use** – 62% forested, 22% agriculture and pasture, 8% urban, 4% mined

### Problems Affecting Species/Habitat

- Impoundment of the Black Warrior River and major tributaries is responsible for loss of large river habitat, fragmentation and isolation of streams and modification of the natural flow regime. [CA1, CA3, CA4, CA6, CA7]
- Water quality degradation, particularly related to abandoned surface mines, agriculture, silviculture and urbanization of the watershed. [CA1, CA2]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many GCN species. [R1 – R16]
- Introduction of, failure to eradicate or control non-native crayfish. [CA5]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Upland Combshell** – Possibly extinct. Conduct survey to determine if the species is extant. If found, initiate a captive rearing program to produce juveniles for reintroduction into suitable habitat. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of mussels propagated and reintroduced.
- R3. **Southern Combshell, Coosa Moccasinshell, Southern Clubshell, Black Sandshell, Alabama Spike, Alabama Hickorynut, Heavy Pigtoe** – Extirpated from Black Warrior drainage. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s):* Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Alabama Spike, Delicate Spike, Triangular Kidneyshell** – Determine systematic relationships among populations from different parts of the Mobile Basin using morphological and genetic analyses. *Product(s):* Determination of systematic relationships between these populations in the river basin.

#### Snails

- R5. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, determine life history requirements, evaluate population viability and identify potential

reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R6. **Cylindrical Lioplax** – Apparently extirpated from Black Warrior drainage. Initiate a captive rearing program using Cahaba River stock to produce juveniles for reintroduction into suitable Black Warrior drainage habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN snails; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of mussels propagated and reintroduced.
- R7. **Plicate Rocksnail** – Black Warrior endemic presently restricted to Locust Fork. Since 2003, that population has been augmented by juveniles produced by TNARI. Continue augmentation and evaluation of population and identify additional reintroduction sites. *Product(s)*: Assessment of the status and/or condition of introduced snails; identification of needed conservation actions including additional population augmentation and/or reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R8. **Black Mudalia** – Black Warrior endemic presently restricted to Locust Fork. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.

### Crayfishes

- R9. **All GCN Species** have very limited and poorly understood distributions. Conduct distribution surveys, determine habitat requirements, investigate life histories, and develop and implement long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R10. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R11. **Blueface Darter** – Determine systematic relationship between Tennessee and Black Warrior populations using morphological and genetic analyses. *Product(s)*: Determination of systematic relationship between Tennessee and Black Warrior populations of blueface darter.



- R12. **Watercress Darter** – Population limited to several springs and spring runs in Jefferson County. Monitor water quality at all sites. Investigate possible gas bubble disease at Roebuck Spring. *Product(s)/Performance measures*: Effective monitoring protocols established or existing monitoring programs utilized/modified to meet CWCS evaluation needs; determination of existence and/or extent of gas bubble disease at Roebuck Spring.
- R13. **Vermilion Darter** – Black Warrior basin endemic. A detailed life history study is needed, including determination of microhabitat requirements for different life stages. *Product(s)*: Knowledge of species' life history, biology and microhabitat requirements to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Vermilion darter.
- R14. **Rush Darter** – Black Warrior basin endemic. Survey springs and spring runs in area encompassed by disjunct populations of this species. A study is needed to determine if there is any genetic structuring within the species. *Product(s)*: Determination of whether genetic structuring within rush darter species exists.

#### Amphibians

- R15. **Black Warrior Waterdog** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of Black Warrior waterdog, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Reptiles

- R16. **Flattened Musk Turtle** – Conduct comprehensive surveys at 3 to 5 year intervals to ascertain status. Conduct studies to further assess the extent of population levels and long-term viability in impoundment situations. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN species, allowing identification of needed conservation actions; long-term population viability analysis in impoundments; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Black Warrior River Basin Management Plan and the Mobile Basin Recovery Plan, including all existing Black Warrior drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of management and recovery plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, USFS, AFC, NRCS, Black Warrior Riverkeeper, Clean Water Partnership, local governments and other partners.**



These activities are most critical in: the Locust Fork drainage, which contains a high number of GCN species and encompasses a large portion of the Birmingham metropolitan area; the Sipsey Fork drainage, where Smith Lake has isolated GCN species to Bankhead National Forest and surrounding areas; and the coal producing areas of the central basin. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA3. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Snails

- CA4. **All GCN Species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability, beginning with the Plicate rocksnail, which is already being augmented in the Locust Fork. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN snails in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Crayfishes

- CA5. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

#### Fishes

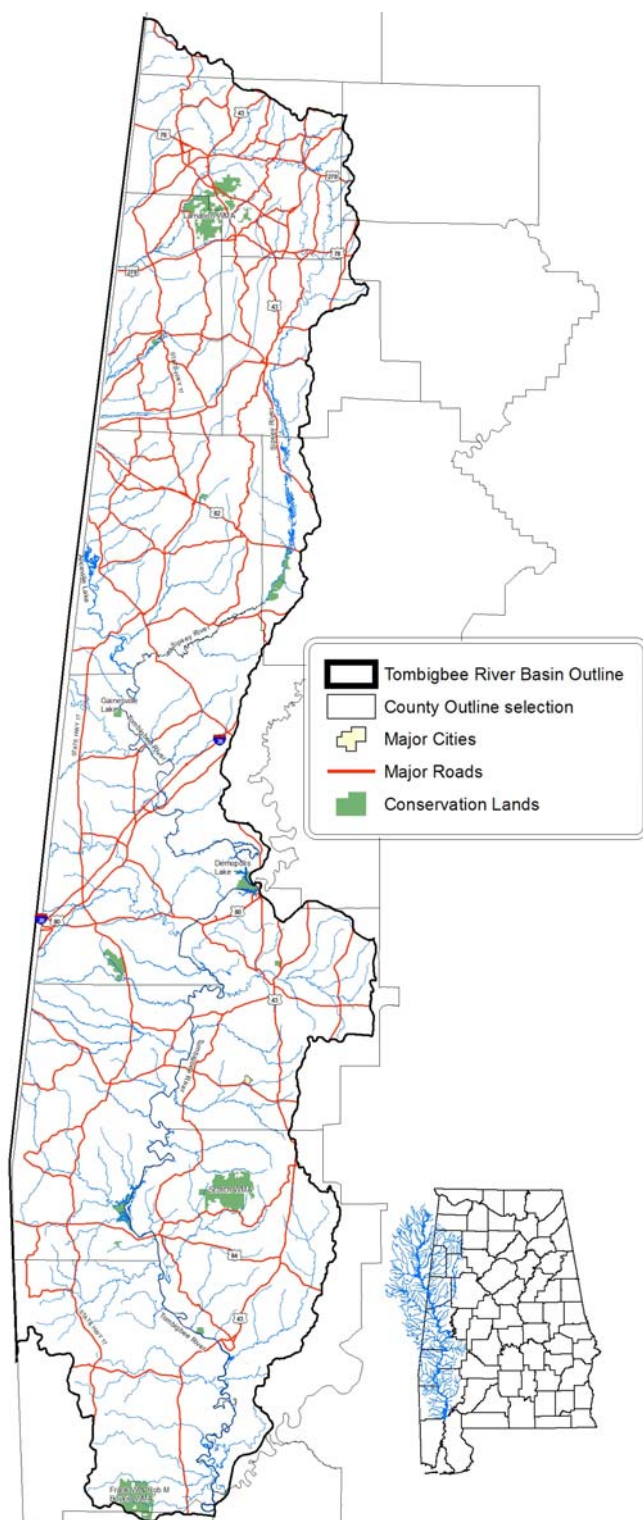
- CA6. **Cahaba Shiner, Rush Darter, Vermilion Darter** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN fish in the river basin; if necessary, number of fish reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.
- CA7. **Watercress Darter** – Glen Spring should be purchased for inclusion in the **Watercress Darter National Wildlife Refuge** by the **USFWS, Forever Wild, TNC and other partners**. *Performance measures:* Acres added to the refuge and/or protected by fee-simple or easements.

## Chapter 4: Conservation Actions

**Priority Areas for Conservation Action**

- Upper Black Warrior Mainstem
- Burnt Cane Creek
- Cane Creek
- Clear Creek (Bankhead NF)
- Fivemile Creek
- Locust Fork of Black Warrior
- Lower Blackwater Creek
- Mill Creek
- North River
- Roebuck Spring
- Sipsev Fork Black Warrior
- Wolf / Lost Creeks
- Thomas Spring
- Glenn Spring
- Yellow Creek
- Lower Black Warrior Mainstem

## Tombigbee River Basin



Buttahatchie River, Marion County *Malcolm Pierson*

### Description and Location

The Tombigbee River flows generally south through east Mississippi and west Alabama, is joined by the Black Warrior River at Demopolis and becomes the Mobile River at its confluence with the Alabama River. The Tombigbee River Basin drains 13,756 square miles, of which 7,660 square miles are in Alabama. The basin is almost entirely contained within the Southeastern Plains. Construction of the Tennessee-Tombigbee Waterway created a link between these two basins, allowing barges to pass from the Tennessee River, through the Tombigbee to the Gulf of Mexico at Mobile Bay.

**TABLE 4-20. GCN SPECIES, TOMBIGBEE RIVER BASIN**

30 GCN SPECIES include 16 mussels, 6 crayfishes, 6 fishes, and 2 reptiles.

<b>MUSSELS (16)</b>		Southern Clubshell	P2	<b>FISHES (6)</b>	
Coosa Moccasinshell	EX	Alabama Heelsplitter	P2	Alabama Sturgeon	P1
Black Clubshell	EX			Ironcolor Shiner	P1
Flat Pigtoe	EX	<b>CRAYFISHES (6)</b>		Gulf Sturgeon	P2
Alabama Spike	P1	<i>Cambarellus lesliei</i>	P2	Alabama Shad	P2
Delicate Spike	P1	<i>Orconectes chickasawae</i>	P2	Bluenose Shiner	P2
Southern Combshell	P1	<i>Orconectes jonesi</i>	P2	Frecklebelly Madtom	P2
Ovate Clubshell	P1	<i>Orconectes mississippiensis</i>	P2		
Heavy Pigtoe	P1	Lagniappe Crayfish	P2	<b>REPTILES (2)</b>	
Triangular Kidneyshell	P1	Southeastern Prairie Crayfish	P2	Rainbow Snake	P2
Rayed Creekshell	P2			Alligator Snapping Turtle	P2
Orangenacre Mucket	P2				
Black Sandshell	P2				
Alabama Moccasinshell	P2				
Alabama Hickorynut	P2				

EX: Extirpated – No longer known to occur in Alabama.

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

### Condition

**Major Impoundments** – three on mainstem in Alabama; Aliceville (8,300 acres), Gainesville (6,400 acres) and Demopolis (10,000 acres): three additional impoundments and five locks upstream in Mississippi

**Land use** – 78% forested, 16% agriculture and pasture, 2% urban

The 2002 ADEM 303(d) list identifies just 16.3 miles of streams in the Tombigbee basin that only partially support their designated uses, due to organic enrichment, metals and pH. In addition, 65 acres of the Olin Basin in Washington County are impaired due to metals and pesticides in contaminated sediments.

### Problems Affecting Species/Habitat

- Impoundment of the Tombigbee River in conjunction with the construction of the Tennessee-Tombigbee Waterway is responsible for loss of most riverine habitat, excessive bank erosion, fragmentation and isolation of streams and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA4, CA6, CA7]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture, industry, and urbanization of the watershed. [CA1, CA3]
- Habitat degradation and alteration from river dredging operations and dredged material disposal, channelization, and desnagging. [CA1, CA3]

- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R13]
- Introduction of, failure to eradicate or control non-native crayfish. [CA5]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN species** should be comprehensively surveyed at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites and host fish availability. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; host fish population availability assessment; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Flat Pigtoe, Black Clubshell** – Tombigbee River endemics, however possibly extinct. Conduct a thorough survey of Tombigbee basin to determine if species are present and to locate potential reintroduction sites. Life history and ecology studies, including identification of glochidial hosts are lacking. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN mussels; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of these mussels; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R3. **Coosa Moccasinshell** – Only extant in Georgia headwaters of Coosa basin. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, a captive propagation program will be needed to supply individuals for reintroduction. *Product(s):* Data to fill information gaps for identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Southern Combshell** – Only extant in Lower Buttahatchee River. Conduct a comprehensive inventory to determine its upstream extent, including evaluation of population viability and identification of potential reintroduction sites. Basic life history information, including identification of glochidial hosts, is lacking. *Product(s):* Data to fill information gaps for mapping abundance and distribution of Southern combshell; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts.
- R5. **Delicate Spike** – Resolve taxonomic problems regarding similar species populations in Gulf Coast drainages. Conduct an inventory of populations to determine distribution, include quantitative assessment to ascertain viability. Conduct life history and ecological studies. *Product(s):* Resolution of taxonomic issues; data to fill information gaps for mapping abundance and distribution of this GCN mussel; knowledge of species' life history and biology to allow land managers, field

- biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Delicate spike; a population viability analysis.
- R6. **Triangular Kidneyshell** – Determine the systematic relationships among populations from different parts of the Mobile Basin using morphological and genetic analyses. Conduct an inventory to determine extent of populations, including quantitative assessments to determine viability, potential reintroduction sites, and host fish availability. *Product(s)*: Determination of systematic relationships amongst populations in river basin; data to fill information gaps for mapping abundance and distribution of this GCN species; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R7. **Ovate Clubshell** – Conduct distribution-wide inventory of species. Conduct life history and ecology studies to determine glochidial host and optimum habitat parameters. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN mussel; knowledge of species' life history, biology and habitat requirements to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Ovate clubshell; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R8. **Heavy Pigtoe** – Only extant populations in Alabama and Tombigbee drainages. Conduct a quantitative assessment, to determine viability, and basic life history and ecology studies, including identification of glochidial host, which are unknown. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN mussel; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Heavy pigtoe; identification of glochidial hosts; a population viability analysis.
- R9. **Rayed Creekshell, Orangenacre Mucket** – Conduct life history and ecology studies, include identification of glochidial host. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of these GCN mussels; identification of glochidial hosts; identification and GIS mapping of key habitats for possible reintroduction.

### Crayfishes

- R10. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R11. **All GCN species** should be comprehensively surveyed at 3 to 5 year intervals, including investigations of life history requirements. *Product(s)*: Data to fill



information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R12. **Alabama Sturgeon** – Continue efforts to collect adult specimens to produce juveniles for population augmentation of this extremely rare species. *Product(s) / Performance measures:* Establishment of captive population; number of fish propagated and reintroduced.
- R13. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Mobile Basin Recovery Plan and the Alabama-Tombigbee Basins Management *Draft*. *Performance measures:* Number of management plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **COE** at Tombigbee River dams. *Performance measures:* Number of dams operated with more natural flow regimes; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed, particularly bank stabilization of Tombigbee River impoundments, by **COE, ADEM, AFC, NRCS, local governments, Clean Water Partnership and other partners**. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA4. Most species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Crayfishes**

- CA5. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

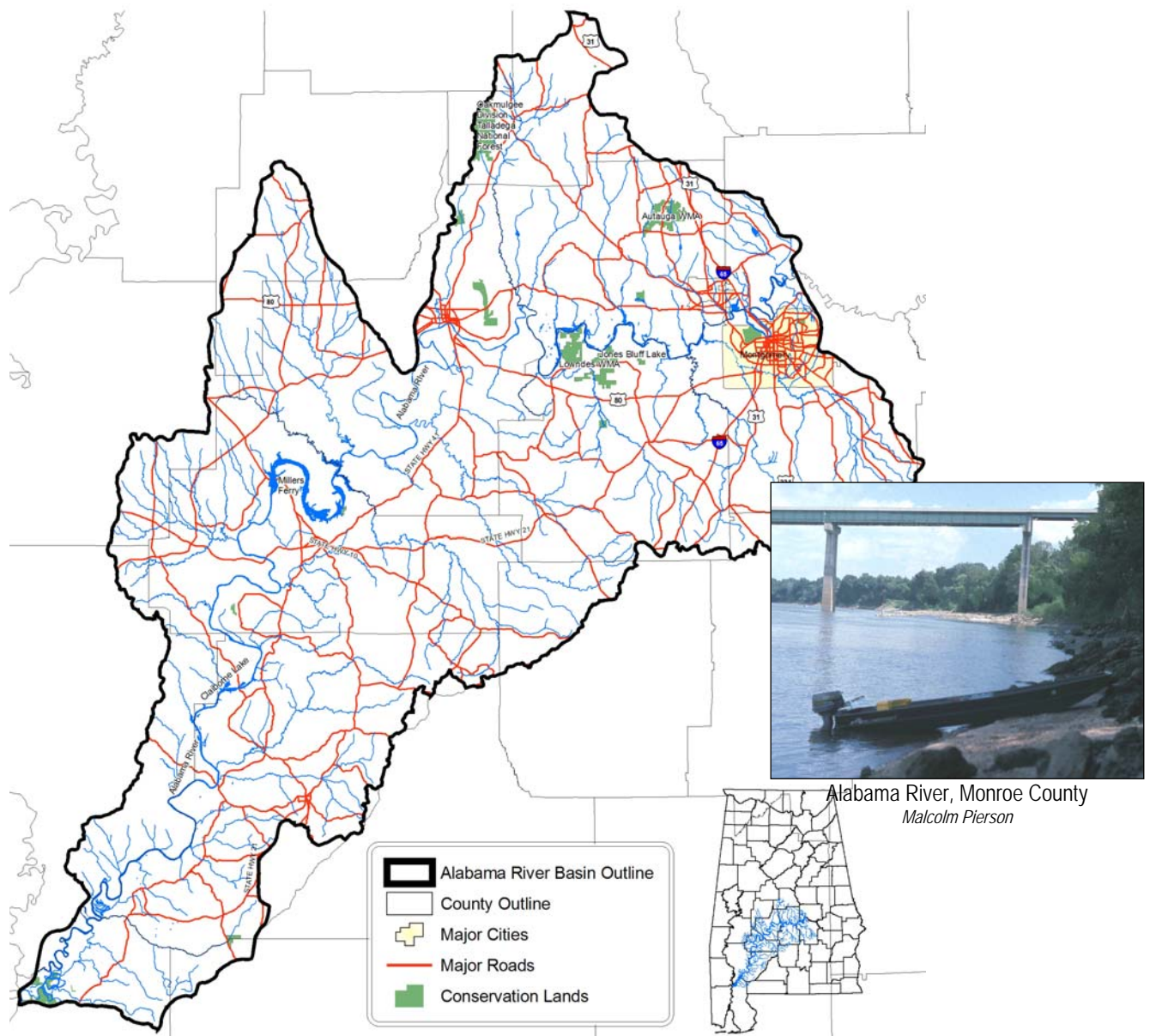
**Fishes**

- CA6. **Alabama Sturgeon, Gulf Sturgeon, Alabama Shad** – Fish passage should be provided by **COE** at Tombigbee River dams to provide access to historic habitat. *Performance measure:* Number of fish passages installed at dams on the Tombigbee River.
- CA7. **Alabama Sturgeon, Ironcolor Shiner, Bluenose Shiner** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of these GCN fish in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Priority Areas for Conservation Action**

- |                       |                                     |
|-----------------------|-------------------------------------|
| • Bull Mountain Creek | • Tombigbee Mainstem at Gainesville |
| • Buttahatchee River  | • Trussells Creek                   |
| • Coal Fire Creek     | • Bassett Creek                     |
| • Noxubee River       | • Jackson Creek                     |
| • Lubbub Creek        | • Lower Tombigbee Mainstem          |
| • Luxapallila Creek   | • Sucarnoochee River                |
| • Sipsey River        |                                     |

## Alabama River Basin



### Description and Location

The Alabama River is formed by the confluence of the Coosa and Tallapoosa Rivers, north of Montgomery. It meanders westward and then southwestward through the Southeastern Plains for 315 miles to its confluence with the Tombigbee River to form the Mobile River. The basin covers an area of 5,956 square miles and is completely within Alabama.

Boschung and Mayden (2004) identify 178 freshwater fish species native to the Mobile basin, of which 136 species are native to the Alabama River basin.

**TABLE 4-21. GCN SPECIES, ALABAMA RIVER BASIN**

31 GCN SPECIES include 15 mussels, 4 snails, 4 crayfishes, 6 fishes, and 2 reptiles.

<b>MUSSELS (15)</b>		Alabama Hickorynut	P2	<b>FISHES (6)</b>	
		Southern Clubshell	P2	Alabama Sturgeon	P1
Alabama Pearlshell*	P1	Alabama Heelsplitter	P2	Ironcolor Shiner	P1
Alabama Spike*	P1			Gulf Sturgeon	P2
Delicate Spike*	P1	<b>SNAILS (4)</b>		Alabama Shad	P2
Southern Combshell*	P1	Cylindrical Lioplax*	P1	Bluenose Shiner	P2
Ovate Clubshell	P1	Tulotoma*	P1	Frecklebelly Madtom*	P2
Heavy Pigtoe	P1	Spotted Rocksnail	P2		
Rayed Kidneyshell	P1	Painted Rocksnail*	P2	<b>REPTILES (2)</b>	
Rayed Creekshell	P2			Rainbow Snake	P2
Finelined Pocketbook	P2	<b>CRAYFISHES (4)</b>		Alligator Snapping Turtle	P2
Orangenacre Mucket	P2	<i>Cambarellus lesliei</i>	P2		
Black Sandshell	P2	<i>Cambarus halli</i>	P2		
Alabama Moccasinshell	P2	<i>Orconectes holti</i>	P2		
		<i>Procambarus lewisi</i>	P2		

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

### Condition

All of the Alabama River except the lower 82 miles is impounded by three COE lock and dam facilities constructed between 1969 and 1974. Dedicated fish passage is not provided at these facilities and fish can pass only under limited circumstances; during lockage, which is infrequent, and when the lowermost dam (Claiborne) is inundated by spring rains, which does not occur every year. This has had obvious impacts on anadromous species and less well understood impacts on freshwater species, some of which have recently been identified to make long freshwater migrations. In addition, flows in the Alabama River are partially regulated by upstream impoundments on the Coosa and Tallapoosa Rivers.

The 2002 ADEM 303(d) list identifies 58 miles of streams in the Alabama basin that indicate water quality impairment and either do not support or only partially support their designated uses. Catoma Creek, which flows through the Montgomery metropolitan area accounts for 23.2 miles of this total. Most of the water quality impairment is due to nutrient and organic enrichment.

**Major Impoundments** – Three dams on mainstem; Jones Bluff (12,500 acres), Millers Ferry (17,200 acres) and Claiborne (5,930 acres)

**Land Use** – 68% forested, 26% agriculture and pasture, 4% urban

### Problems Affecting Species/Habitat

- Impoundment of the Alabama River is responsible for loss of most riverine habitat, fragmentation, altered flow regimes, and restricted access to spawning habitats. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA3, CA4, CA5, CA7, CA8]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA2, CA3]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for many GCN species is a major problem. [R1 – R14]
- Introduction of, failure to eradicate or control non-native crayfish. [CA6]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Southern Combshell** – Extirpated from Alabama drainage but remains extant in Buttahatchee River in Tombigbee basin. Conduct a comprehensive survey for potential reintroduction sites. If sites are found, institute a captive propagation program using Buttahatchee River stock. Basic life history studies, including identification of glochidial hosts, will be necessary. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of Southern combshell; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts.
- R3. **Delicate Spike** – Resolve taxonomic and distributional problems between Mobile Basin and Gulf Coast drainage populations. Conduct an inventory of species populations and a quantitative assessment to ascertain their viability. Conduct basic life history and ecological studies. *Product(s)*: Resolution of taxonomic issues; data to fill information gaps for mapping abundance and distribution of this GCN mussel; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Delicate spike; a population viability analysis.
- R4. **Rayed Kidneyshell** – Determine systematic relationships among populations from different parts of the Mobile Basin using morphological and genetic analyses. Conduct a comprehensive inventory, evaluate population viability and identify potential reintroduction sites. *Product(s)*: Determination of systematic relationships throughout the basin; data to fill information gaps for mapping abundance and

distribution of this GCN species; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction.

- R5. **Finelined Pocketbook** – Mobile Basin endemic. Conduct phylogenetic studies to assess taxonomic status regarding possibility of two or more cryptic species being present within its distribution. Conduct an inventory of populations and a quantitative assessment to ascertain viability of populations, as well as potential reintroduction sites and availability of potential fish hosts. *Product(s)*: Determination of taxonomic status of possible cryptic species; data to fill information gaps for mapping abundance and distribution of Finelined pocketbook; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R6. **Alabama Pearlshell** – Only historically found in Conecuh drainage and Limestone Creek of Alabama drainage but may be extirpated from Limestone Creek. Conduct a comprehensive survey of Limestone Creek to determine if species is still present and to identify potential reintroduction sites. If necessary, institute a captive propagation program using Conecuh basin stock. Basic life history studies, including identification of glochidial hosts, will be necessary. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of Alabama pearlshell; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.

### Snails

- R7. **All GCN Species** – Conduct distribution surveys at 2-year intervals and life history investigations. This should include evaluation of population viability and identification of potential reintroduction sites because all species are candidates for population augmentation and/or reintroduction. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN snails, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R8. **Cylindrical Lioplax** – Believed to be extirpated from Alabama drainage. Initiate a captive rearing program using Cahaba River stock to produce juveniles for reintroduction into suitable Alabama drainage habitat. *Product(s) / Performance measures*: Data to fill information gaps for mapping abundance and distribution of this GCN species; identification and GIS mapping of key habitats for possible reintroduction; establishment of a captive propagation program; number of mussels propagated and reintroduced.
- R9. **Spotted Rocksnail** – Only extant population in Alabama River drainage. Conduct a comprehensive inventory to determine extent of population, evaluate population viability and conduct life history and ecological studies. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of spotted rocksnail; a population viability analysis; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions.



- R10. **Tulotoma, Painted Rocksnail** – Extirpated from Alabama drainage. Survey for potential reintroduction sites. Qualitatively determine distribution and potential reintroduction sites. Conduct life history and ecology studies for the Painted Rocksnail. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these rocksnails; population viability analyses; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification and GIS mapping of key habitats for possible reintroduction;.

#### Crayfishes

- R11. **All GCN Species** have very limited and uncertain distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Fishes

- R12. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R13. **Alabama Sturgeon** – Continue efforts to collect adult specimens to produce juveniles for population augmentation of this extremely rare species. *Product(s) / Performance measures*: Establishment of captive population; number of fish propagated and reintroduced.
- R14. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Alabama-Tombigbee Rivers Basin Management Plan and the Mobile Basin Recovery Plan, including all existing Alabama drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of management and recovery plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.

- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **COE** at Alabama River dams. *Performance measures:* Number of dams operated with more natural flow regimes; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, local governments, Clean Water Partnership and other partners**. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA4. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Snails

- CA5. **All GCN Species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN snails in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Crayfishes

- CA6. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

#### Fishes

- CA7. **Alabama Sturgeon, Gulf Sturgeon, Alabama Shad** – Fish passage should be provided by **COE** at Alabama River dams to provide access to historic habitat in the Alabama, Cahaba, Coosa and Tallapoosa Rivers. *Performance measure:* Number of fish passages installed at dams on the Alabama River.
- CA8. **Alabama Sturgeon, Ironcolor Shiner, Bluenose Shiner** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of these GCN fish in the river basin; if necessary, number of mussels reintroduced or added to

## Chapter 4: Conservation Actions

suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Priority Areas for Conservation Action**

- Upper Alabama River Mainstem
- Big Swamp Creek
- Bogue Chitto Creek
- Catoma Creek
- Chilatchee Creek
- Dry Cedar Creek
- Little Mulberry Creek
- Little River
- Lower Alabama River Mainstem
- Mulberry Creek
- Pine Log Creek
- Pintlala Creek
- Reedy / Little Reedy / Sand Hill Creeks
- Limestone Creek

## Chattahoochee River Basin



Little Uchee Creek, Lee County

Malcolm Pierson

### Description and Location

The Chattahoochee River originates in the Piedmont of northeast Georgia and flows southwest through the Atlanta metropolitan area. Just downstream of West Point Dam, it forms the border of Alabama and Georgia, crosses the fall line into the Southeastern Plains at Phenix City and continues on to the Florida panhandle, where its confluence with the Flint River in Lake Seminole forms the Apalachicola River. The Chipola River is an Apalachicola River tributary with its headwaters in extreme southeast Alabama (Houston County). For the purposes of this document, the Chipola River is included with the Chattahoochee River drainage. The Chattahoochee River has a drainage area of 8,700 square miles, of which 2,832 square miles are in Alabama.

**TABLE 4-22. GCN SPECIES, CHATTAHOOCHEE RIVER BASIN**

27 GCN SPECIES include 12 mussels, 2 crayfishes, 8 fishes, 2 amphibians and 3 reptiles.

MUSSELS (12)		CRAYFISHES (2)		AMPHIBIANS (2)	
Chipola Slabshell	EX	<i>Cambarus howardi</i>	P2	River Frog	P1
Brother Spike	EX	<i>Procambarus lewisi</i>	P2	One-toed Amphiuma	P2
Green Floater	EX				
Southern Elktoe	P1	FISHES (8)			
Inflated Spike	P1	Ironcolor Shiner	P1		
Shinyrayed Pocketbook	P1	Halloween Darter	P1	REPTILES (3)	
Gulf Moccasinshell	P1	Gulf Sturgeon	P2	Rainbow Snake	P2
Purple Bankclimber	P1	Alabama Shad	P2	Alligator Snapping Turtle	P2
Oval Pigtoe	P1	Dusky Shiner	P2	Barbour's Map Turtle	P2
Sculptured Pigtoe	P1	Broadstripe Shiner	P2		
Rayed Creekshell	P2	Bluenose Shiner	P2		
Downy Rainbow	P2	Shoal Bass	P2		

EX: Extirpated – No longer known to occur in Alabama.

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

### Condition

**Major Impoundments** – Eleven dams on mainstem; West Point (25,864 acres), Langdale (152 acres), River View (75 acres), Bartletts Ferry (5,860 acres), Goat Rock (1,000 acres), Oliver (3,000 acres), North Highlands (131 acres), City Mills (110 acres), Eagle/Phenix (45 acres), Eufaula (45,180 acres) and Andrews (1,540 acres)

**Land Use** – 66% forested, 25% agriculture and pasture, 5% urban.

The 2002 ADEM 303(d) list identifies only 37 miles of streams in the Chattahoochee basin with impaired water quality that either do not support or only partially support their designated uses. Barbour Creek accounts for 21.9 miles of this total and is impaired by siltation of agricultural origin. In the Georgia portion of the basin, 267 miles of rivers and streams fail to meet or only partially meet water quality standards. In addition, West Point, Bartletts Ferry, Goat Rock, Oliver, Eufaula and Andrews Reservoirs fail to meet or only partially meet water quality standards. Sufficient flow for wastewater assimilation in the Chattahoochee is most critical in the reach between Atlanta and West Point Reservoir.

### Problems Affecting Species/Habitat

- Impoundment of the Chattahoochee River is responsible for loss of most riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA3, CA4, CA6]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture, surface mining, wastewater treatment, and

urbanization of the watershed. This is a critical problem in Uchee Creek. [CA1, CA2]

- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R12]
- Introduction of, failure to eradicate or control non-native crayfish. [CA5]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Brother Spike, Chipola Slabshell** – Chattahoochee basin endemics. Apparently extirpated from Alabama portion of the basin. Conduct a comprehensive inventory to determine if species are extant in Alabama. Evaluate population viability and determine identity of glochidial hosts and potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance and distribution of these GCN species, allowing identification of needed conservation actions; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Green Floater** – Apparently extirpated from the entire basin. Conduct a comprehensive inventory to determine if species is extant in Alabama. If found, an evaluation of population viability and identity of glochidial hosts and potential reintroduction sites should be carried out. *Product(s)*: Data to fill information gaps to determine the abundance and distribution of green floater, allowing identification of needed conservation actions; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Gulf Moccasinshell, Inflated Spike, Southern Elktoe** – Endemic to Chattahoochee basin. Conduct a comprehensive inventory and basic life history and ecology studies. Include evaluation of population viability and identification of glochidial hosts and potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance and distribution of these GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts; inclusion in



and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R5. **Oval Pigtoe, Sculptured Pigtoe, Purple Bankclimber, Shinyrayed Pocketbook, Downy Rainbow** – Very limited distribution in Alabama portion of Chattahoochee basin. Conduct a thorough survey to determine extent and viability of populations. Include assessment of potential host fishes and reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance and distribution of these GCN mussels, allowing identification of needed conservation actions; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction; host fish population availability assessment; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Crayfishes

- R6. **All GCN Species** have very limited and poorly defined distributions. Conduct distribution surveys, determine habitat requirements and investigate life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R7. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R8. **Broadstripe Shiner** – Chattahoochee basin endemic. Conduct distribution survey to determine extent of populations. Determine genetic structure within and between populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; determination of genetic structure within and between populations of broadstripe shiner.
- R9. **Halloween Darter** – Chattahoochee basin endemic. In Alabama, restricted to Uchee and Little Uchee Creeks. Conduct an immediate assessment to determine population viability and survey nearby streams for additional populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; a population viability analysis.
- R10. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

**Amphibians**

- R11. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN amphibians, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R12. **River Frog, One-toed Amphiuma** – Conduct intensive survey to determine distribution and abundance of populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

**Highest Priority Conservation Actions Needed and Key Partnership Opportunities****All GCN Species**

- CA1. Support full implementation of the Chattahoochee-Chipola Rivers Basin Management Plan, including all existing Chattahoochee drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of management and recovery plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, local governments, Clean Water Partnership and other Alabama and Georgia partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA3. Support proposed removal of City Mills and Eagle/Phenix dams to restore riverine habitat under Section 206 of Water Resources Act of 1996 by **COE, cities of Phenix City, Alabama and Columbus, Georgia**. *Performance measures*: Removal of City Mills and Eagle/Phenix dams; stream miles restored.

**High Priority Conservation Actions Needed and Key Partnership Opportunities****Mussels**

- CA4. Most species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Crayfishes**

CA5. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

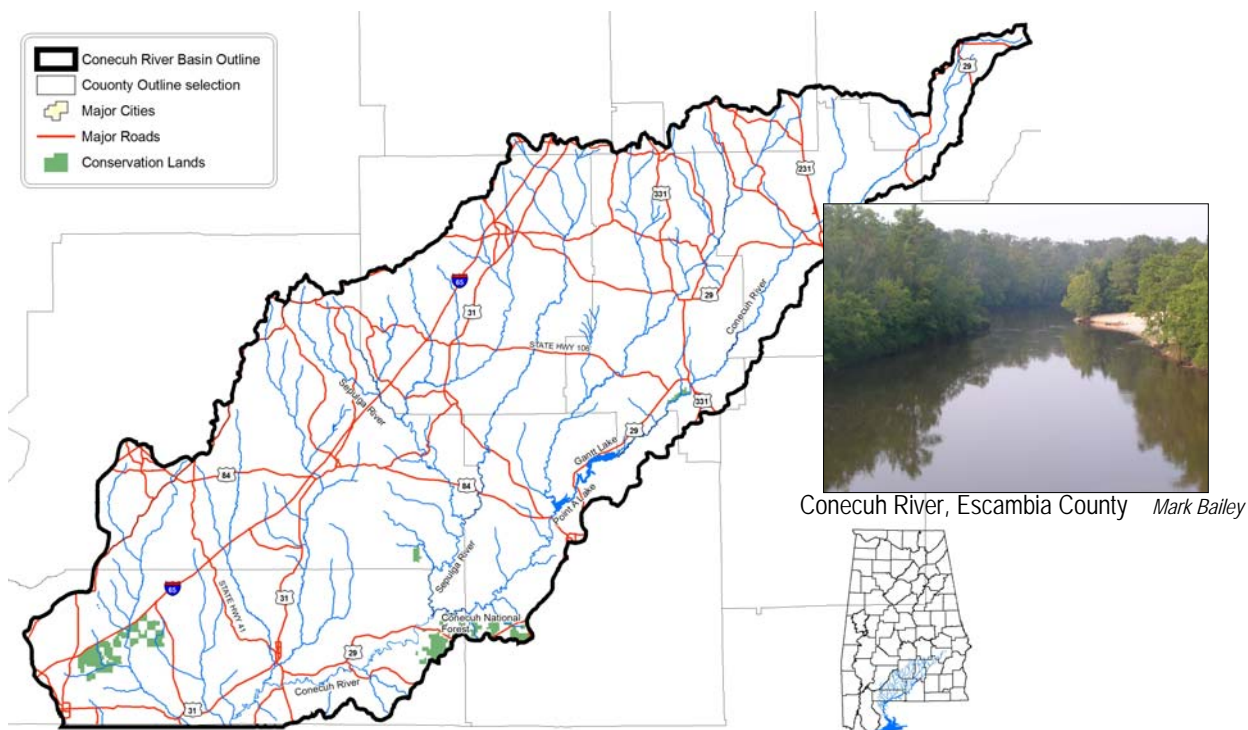
**Fishes**

CA6. **Ironcolor Shiner, Broadstripe Shiner** – May require population augmentation and/or reintroduction to suitable habitats to maintain viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition; if necessary, number of shiners reintroduced to suitable habitats.

**Priority Areas for Conservation Action**

- Chattahoochee River Mainstem
- Uchee Creek (including Little Uchee Creek)
- Chipola River / Big Creek

## Conecuh River Basin



### Description and Location

The Conecuh River Basin originates in south central Alabama and extends through the Florida panhandle, where it becomes the Escambia River at its confluence with Big Escambia Creek. The Conecuh basin forms the principal drainage of Pensacola Bay and covers an area of 4,223 square miles, 90 percent of which is in Alabama. The basin is characterized by sandy, well-drained soils. The primary flow results from rainfall with some groundwater influence.

Boschung and Mayden (2004) identify 84 freshwater fish species native to the Alabama waters draining to Pensacola Bay, primarily the Conecuh basin but also the smaller Yellow and Blackwater basins. For these same waters, Schuster and Taylor (2004) identify 18 crayfish species, representing greater diversity than other Alabama coastal basins (Chattahoochee, Choctawhatchee, Perdido, Escatawpa).

### Condition

Two hydroelectric dams were constructed on the Conecuh River near Andalusia in the 1920's. The downstream dam (Point A) has a watershed of 1,259 square miles, about one-third of the Alabama portion of the Conecuh basin. These dams are currently operated by AEC under a FERC license that expires in 2005. The new license is expected to specify a continuous minimum flow from Point A to enhance aquatic resources, but fish passage is not presently under consideration.

**TABLE 4-23. GCN SPECIES, CONECUH RIVER BASIN**

19 GCN SPECIES include 9 mussels, 2 crayfishes, 4 fishes, 2 amphibians and 2 reptiles.

MUSSELS (9)		CRAYFISHES (2)		AMPHIBIANS (2)	
Alabama Pearlshell	P1	<i>Procambarus capillatus</i>	P2	River Frog	P1
Narrow Pigtoe	P1	<i>Procambarus escambiensis</i>	P2	One-toed Amphiuma	P2
Round Ebonyshell	P1				
Southern Sandshell	P1	FISHES (4)		REPTILES (2)	
Southern Kidneyshell*	P1	Ironcolor Shiner	P1	Rainbow Snake	P2
Rayed Creekshell	P2	Gulf Sturgeon	P2	Alligator Snapping Turtle	P2
Fuzzy Pigtoe	P2	Alabama Shad	P2		
Choctaw Bean	P2	Bluenose Shiner	P2		
Downy Rainbow	P2				

P1: Priority 1 – Highest Conservation Concern.

P2: Priority 2 – High Conservation Concern.

\*In addition to species extirpated from Alabama waters (Ex), species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

The Conecuh basin has a history of water quality impacts from agricultural, industrial and municipal sources. However, water quality has improved substantially over the last 20 years. The 2002 ADEM 303(d) list identifies 52.4 miles of streams in the Conecuh basin that either do not support or only partially support their designated uses, including 42.7 miles of the Conecuh River, both upstream and downstream of Gantt and Point A Reservoirs. Most impairment is due to siltation and organic enrichment from agricultural sources.

**Major Impoundments** – Gantt (2,747 acres) and Point A (700 acres)

**Land Use** – 81% forested, 15% agriculture and pasture, 2% urban

### Problems Affecting Species/Habitat

- Impoundments on the Conecuh River are responsible for loss of some riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA4, CA5, CA7, CA8]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture, sand and gravel mining, and urbanization of the watershed. [CA1, CA2, CA3]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R11]
- Introduction of, failure to eradicate or control non-native crayfish. [CA6]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

#### Mussels

- R1. **All GCN species** should be comprehensively surveyed at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Southern Kidneyshell** – Conduct intensive surveys to determine if species is still extant in the basin. Conduct life history and ecology studies, including identification of glochidial host. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN mussel; identification of glochidial hosts; a population viability analysis; host fish population availability assessment; identification and GIS mapping of key habitats for possible reintroduction.
- R3. **Southern Sandshell** – Endemic to Gulf Coast drainages. Conduct an inventory of populations, including quantitative assessments to ascertain population viability and availability of potential fish hosts. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN mussel; identification of glochidial hosts; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Choctaw Bean** – Conduct quantitative assessments to ascertain population viability, include life history and ecology studies, and identification of glochidial host. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Choctaw bean; identification of glochidial hosts; a population viability analysis.
- R5. **Round Ebonyshell** – Conecuh basin endemic, currently confined to main channel of Conecuh River. Perform qualitative survey to determine exact range of species. Assess the need for augmentation using propagated juveniles. Conduct life history and ecological studies, including identification of glochidial host. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Round ebonyshell; identification of glochidial hosts.
- R6. **Rayed Creekshell, Fuzzy Pigtoe, Alabama Pearlshell, Narrow Pigtoe** – Conduct life history and ecology studies, include identification of glochidial host. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of these GCN species; identification of glochidial hosts; host fish population availability assessment; identification and GIS mapping of key habitats for possible reintroduction.
- R7. **Downy Rainbow** – Conduct a thorough survey to determine distribution within the Conecuh River basin, include quantitative assessment to determine viability.



*Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN mussels; population viability analysis.

### Crayfishes

- R8. **All GCN Species** have very limited and poorly defined distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s):* Data to fill information gaps for mapping abundance and distribution of GCN crayfish; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R9. **All GCN species** should be comprehensively surveyed at 3 to 5 year intervals, including investigations of life history requirements. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R10. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Amphibians

- R11. **River Frog, One-toed Amphiuma** – Conduct intensive survey to determine distribution and abundance of populations. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

## Highest Priority Conservation Actions Needed and Key Partnership Opportunities

### All GCN Species

- CA1. Support full implementation of the Conecuh-Sepulga-Blackwater Rivers Watershed Protection Plan. *Performance measures:* Number of watershed protection plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **AEC** at Conecuh River dams. *Performance measures:* Number of dams operated with more natural flow regimes; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed.

- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments, Clean Water Partnership and other partners**. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA4. Construction of new dams within the basin (including downstream in Florida) would be highly detrimental to most GCN species and should be discouraged. *Performance measures:* Number of new dams constructed; number of plans/permits commented on.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA5. Most species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Crayfishes

- CA6. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

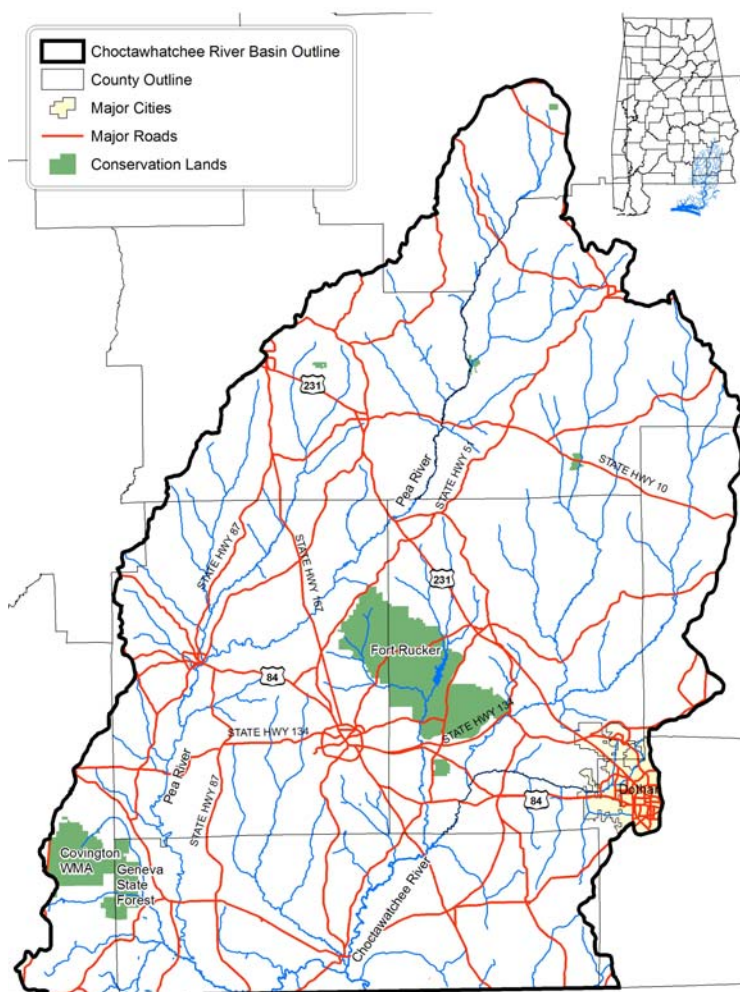
#### Fishes

- CA7. **Gulf Sturgeon** – Support designation of critical habitat in the Choctawhatchee, Conecuh and Yellow River basins. *Performance measure:* Designation of such critical habitat.
- CA8. **Ironcolor Shiner, Bluenose Shiner** – Species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of these GCN fish in the river basin; if necessary, number of fish reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

### Priority Areas for Conservation Action

- Conecuh River and tributaries (including Sepulga River, Pigeon Creek and Big Escambia Creek)

## Choctawhatchee River Basin



Steep Head Creek, Dale County  
*Mark Bailey*

### Description and Location

The Choctawhatchee River Basin originates in southeast Alabama and extends through the Florida panhandle to Choctawhatchee Bay. The 3,130 square miles of the basin in Alabama is about equally divided between the Choctawhatchee River and the Pea River drainages.

The Choctawhatchee basin is home to 119 fish species (Boschung and Mayden 2004) and 25 mussels (GSA). Recent surveys (1998-2000) documented 21 mussel species (GSA).

**TABLE 4-24. GCN SPECIES, CHOCTAWHATCHEE RIVER BASIN**

17 GCN SPECIES include 8 mussels, 4 fishes, 2 amphibians and 3 reptiles.

<b>MUSSELS (8)</b>		Downy Rainbow	P2	<b>AMPHIBIANS (2)</b>	
Fluted Elephantear	P1			River Frog	P1
Southern Sandshell	P1	<b>FISHES (4)</b>		One-toed Amphiuma	P2
Southern Kidneyshell	P1	Ironcolor Shiner	P1		
Rayed Creekshell	P2	Gulf Sturgeon	P2	<b>REPTILES (3)</b>	
Tapered Pigtoe	P2	Alabama Shad	P2	Rainbow Snake	P2
Fuzzy Pigtoe	P2	Bluenose Shiner	P2	Alligator Snapping Turtle	P2
Choctaw Bean	P2			Barbour's Map Turtle	P2

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

### Condition

The aquatic fauna of the Choctawhatchee basin is largely intact due to the absence of large impoundments in the drainage. The 2002 ADEM 303(d) list identifies only 20 miles of streams in the Choctawhatchee basin with impaired water quality that either do not support or only partially support their designated uses. Most impairment is due to nutrients, organic enrichment and pathogens from urban and agricultural sources.

**Major Impoundments** – Elba, on Pea River

**Land Use** – 54% forested, 39% agriculture and pasture, 4% urban

### Problems Affecting Species/Habitat

- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA1, CA2]
- Habitat degradation and alteration from river dredging operations and drainage of bottomland forests and swamps. [CA1, CA5, CA6, CA7]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for most GCN species is a major problem. [R1 – R10]
- Elba Dam on the Pea River impedes fish passage of anadromous species and mussel host species. Construction of new dams within the Choctawhatchee basin would result in loss of more riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. [CA1, CA3, CA4]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species and their conservation actions please see *Alabama Wildlife Volumes 2, 3, and 4* (Mirarchi et al. 2004 b, c, and d).

#### Mussels

- R1. **All GCN Species** – Conduct comprehensive surveys at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill

information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R2. **Fluted Elephantear, Tapered Pigtoe** – Endemic to Choctawhatchee. Conduct a quantitative assessment to determine viability, and basic life history and ecology studies, determine identity of glochidial hosts and potential reintroduction sites. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions and identify needed conservation actions; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts.
- R3. **Southern Kidneyshell** – Only recent records from West Fork of Choctawhatchee. Conduct intensive survey and quantitative assessment to determine true distribution and population viability. Conduct basic life history studies, and identify glochidial hosts and potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of Southern kidneyshell, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts.
- R4. **Downy Rainbow** – Possibly extant in Eight-mile Creek. Conduct a thorough survey to determine if species is extant, and a quantitative assessment to determine viability. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN mussel, allowing identification of needed conservation actions; a population viability analysis; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. **Southern Sandshell** – Endemic to Gulf Coast drainages. Conduct an inventory of populations and a quantitative assessments to ascertain population viability and availability of potential fish hosts. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN mussel, allowing identification of needed conservation actions; a population viability analysis; host fish population availability assessment.
- R6. **Rayed Creekshell, Fuzzy Pigtoe, Choctaw Bean** – Conduct a comprehensive inventory followed by basic life history and ecology studies. Evaluate population viability, determine identity of glochidial hosts, and survey for potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts.

#### Fishes

- R7. **All GCN Species** – Conduct comprehensive surveys at 3 to 5 year intervals, and determine life history requirements. *Product(s)*: Data to fill information gaps to



determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R8. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

#### Amphibians

- R9. **River Frog, One-toed Amphiuma** – Conduct intensive survey to determine distribution and abundance of populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Reptiles

- R10. **Barbour's Map Turtle** – Conduct distribution surveys every 3 to 5 years, including life history investigations and long-term quantitative monitoring. Determine systematic relationships among populations from different Gulf Coast drainages using morphological and genetic analyses. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN turtle; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; determination of systematic relationships between populations.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Choctawhatchee-Pea-Yellow River Basins Management Plan, including all existing Choctawhatchee drainage species recovery plans and relevant recovery or management plans developed within the next ten years that promote conservation of these GCN species and their habitats. *Performance measures*: Number of management and recovery plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, Choctawhatchee-Pea Rivers Watershed Management Authority, local governments, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.



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- CA3. Fish passage should be provided at the Elba Dam on the Pea River to provide Gulf sturgeon and Alabama shad access to historic habitat and allow free movement of mussel host species. *Performance measure*: Fish passage installed at Elba Dam.
- CA4. Construction of new dams within the basin (including downstream in Florida) would be highly detrimental to most GCN species and should be discouraged. *Performance measures*: Number of new dams constructed; number of plans/permits commented on.

**High Priority Conservation Actions Needed and Key Partnership Opportunities****Mussels**

- CA5. Most species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

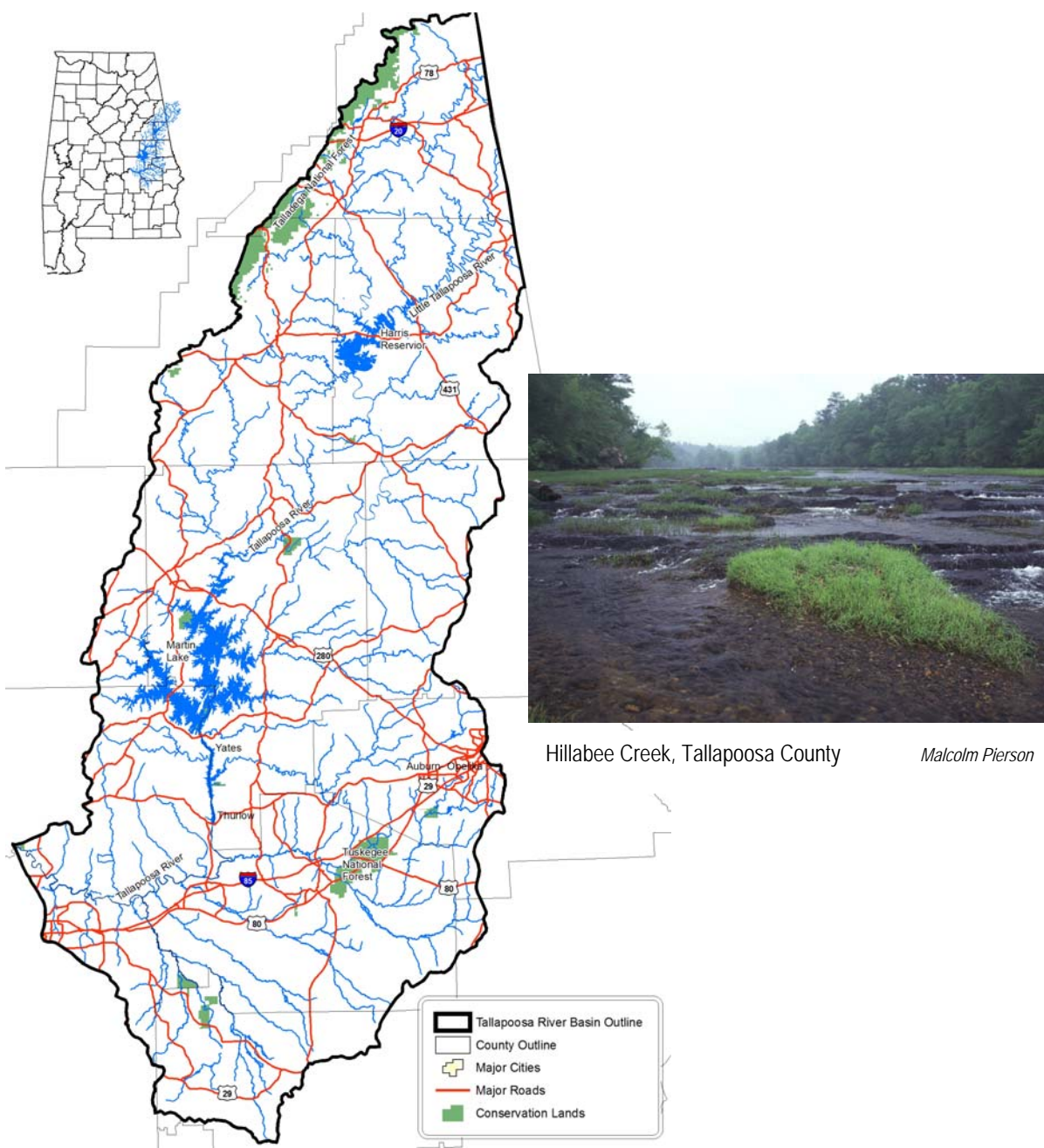
**Fishes**

- CA6. **Gulf Sturgeon** – Support designation of critical habitat in the Choctawhatchee, Conecuh and Yellow River basins. *Performance measure*: Designation of such critical habitat.
- CA7. **Ironcolor Shiner** – May require population augmentation and/or reintroduction to suitable habitats to maintain viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of this GCN fish in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Priority Areas for Conservation Action**

- Choctawhatchee / Pea River and tributaries (including Pea River, Little Choctawhatchee River, West Fork of Choctawhatchee and Eight-mile Creek)

## Tallapoosa River Basin



### Description and Location

The Tallapoosa River Basin originates in west-central Georgia and flows generally southwest to join the Coosa River north of Montgomery, forming the Alabama River. The Tallapoosa basin is largely contained within the Piedmont, except the lower 60 miles of the Tallapoosa River and drainage are within the Southeastern Plains. The basin has a total area of 4,675 square miles, 85% of which is in Alabama.

**TABLE 4-25. GCN SPECIES, TALLAPOOSA RIVER BASIN**

16 GCN SPECIES include 8 mussels, 3 crayfishes, 4 fishes, and 1 reptile.

<b>MUSSELS (8)</b>		Southern Clubshell		P2	<b>FISHES (4)</b>	
Delicate Spike	P1	Alabama Heelsplitter*	P2		Alabama Sturgeon*	P1
Ovate Clubshell	P1	Alabama Creekmussel	P2		Gulf Sturgeon*	P2
Rayed Creekshell	P2				Alabama Shad*	P2
Finelined Pocketbook	P2	<b>CRAYFISHES (3)</b>			Lipstick Darter	P2
Black Sandshell*	P2	<i>Cambarus englishi</i>	P2			
		<i>Cambarus halli</i>	P2		<b>REPTILES (1)</b>	
		<i>Cambarus cracens</i>	P2		Alligator Snapping Turtle	P2

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

\*Species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

### Condition

The 2002 ADEM 303(d) list identifies 91.5 miles of streams in the Tallapoosa basin that either do not support or only partially support their designated uses, due to various causes including siltation, pathogens, nutrients and organic enrichment. Siltation related to sand and gravel mining in Macon County accounts for 66.1 miles of this total. In addition, 224 acres of the Sougahatchee Creek embayment of Yates Reservoir are impaired due to nutrients and organic enrichment.

**Major Impoundments** – four on mainstem; Harris (10,661 acres), Martin (39,000 acres), Yates (1,980 acres) and Thurlow (585 acres)

**Land use** – 73% forested, 17% agriculture and pasture, 4% urban

### Problems Affecting Species/Habitat

- Impoundment of the Tallapoosa River is responsible for loss of most riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. The impoundments also exacerbate problems with nutrient pollution and low dissolved oxygen. [CA1, CA2, CA3, CA4, CA6]
- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture, and urbanization of the watershed. [CA1, CA2, CA3]
- Current distribution and status, as well as knowledge of various aspects of life history and biology are poorly known for many species. [R1 – R7]
- Introduction of, failure to eradicate or control non-native crayfish. [CA5]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

#### Mussels

- R1. **All GCN species** should be comprehensively surveyed at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population

- viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Delicate Spike** – Resolve taxonomic and distributional problems between Mobile Basin and Gulf Coast drainage populations. Conduct an inventory of populations to determine distribution, include quantitative assessment to ascertain viability. Conduct life history and ecological studies, include identification of glochidial host. *Product(s)*: Resolution of taxonomic issues; data to fill information gaps for mapping abundance and distribution of this GCN mussel; knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions regarding protection of Delicate spike; a population viability analysis; identification of glochidial host.
- R3. **Ovate Clubshell, Alabama Creekmussel** – Mobile basin endemics. Conduct distribution-wide inventory of species. Conduct life history and ecology studies to determine glochidial host and optimum habitat parameters. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN mussels; knowledge of species' life history, biology and habitat requirements to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts; identification and GIS mapping of key habitats for possible reintroduction.
- R4. **Finelined Pocketbook** – Mobile basin endemic. Conduct phylogenetic studies to assess the taxonomic status, regarding possible presence of two or more cryptic species. Conduct inventory of populations, including quantitative assessment to ascertain viability, as well as evaluation of potential reintroduction sites and host fish availability. *Product(s)*: Determination of taxonomic status of possible cryptic species; data to fill information gaps for mapping abundance and distribution of Finelined Pocketbook; host fish availability assessment; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction.
- R5. **Rayed Creekshell** – Conduct life history and ecology studies, include identification of glochidial host. Survey for potential reintroduction sites and host fish availability. *Product(s)*: Knowledge of species' life history and biology to allow land managers, field biologists, and others to identify needed conservation actions and make informed decisions; identification of glochidial hosts; host fish availability assessment; identification and GIS mapping of key habitats for possible reintroduction.

### Crayfishes

- R6. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements

and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R7. **Lipstick Darter** – Tallapoosa basin endemic. Conduct distribution survey to determine extent of populations. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Mobile Basin Recovery Plan and Tallapoosa Basin Management Plan. *Performance measures*: Number of management plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Support implementation of more natural flow regimes and full compliance with water quality standards by **APC** at Tallapoosa River dams. Ongoing continuous flows from Thurlow Dam and initiation of continuous flows from Harris Dam are of particular importance. *Performance measures*: Number of dams operated with more natural flow regimes; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs and new monitoring programs developed.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Mussels

- CA4. **Most GCN species** may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

#### Crayfishes

- CA5. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures*: Population status and

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condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

**Fishes**

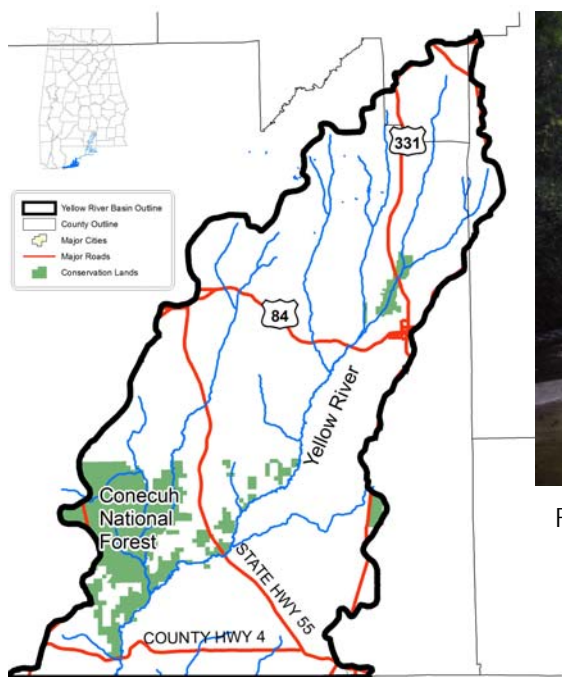
- CA6. **Gulf Sturgeon, Alabama Shad** – Fish passage should be provided by **COE** at Alabama River dams to provide access to historic habitat in the Alabama, Cahaba, Coosa and Tallapoosa Rivers. *Performance measure:* Number of fish passages installed at dams on the Alabama River.

**Priority Areas for Conservation Action**

- Calebee Creek
- Gold Branch
- Little Tallapoosa River
- Lower Tallapoosa River Mainstem
- Middle Tallapoosa River Mainstem and tributaries
- Uphabee / Chewacla / Opintlocco Creeks
- Upper Tallapoosa River Mainstem



## Yellow River Basin



Five Runs Creek, Covington County

Malcolm Pierson

### Description and Location

The Yellow River basin has a total area of 1,365 square miles. In Alabama, the basin is limited primarily to the eastern half of Covington County and encompasses an area of 507 square miles. The Yellow River then flows southwest through the Florida panhandle for 61 miles, forms northern boundary of Eglin Air Force Base and empties into Pensacola Bay.

Boschung and Mayden (2004) identify 84 freshwater fish species native to the Alabama waters draining to Pensacola Bay, primarily the Conecuh basin but also the smaller Yellow and Blackwater basins. For these same waters, Schuster and Taylor (2004) identify 18 crayfish species, representing greater diversity than other Alabama coastal basins (Chattahoochee, Choctawhatchee, Perdido, Escatawpa).

### Condition

Land use in the basin is primarily silviculture and agriculture and water quality is generally very good. No streams in the Alabama portion of the basin are included in the 2002 ADEM 303(d) list of impaired waters. Recently, Okaloosa County, Florida has proposed constructing a water supply impoundment on the Yellow River.

**Major Impoundments** – None

**Land use** – 71% forested, 24% agriculture and pasture, 3% urban

**TABLE 4-26. GCN SPECIES, YELLOW RIVER BASIN**

16 GCN SPECIES include 6 mussels, 2 crayfishes, 4 fishes, 2 amphibians, and 2 reptiles.

MUSSELS (6)		CRAYFISHES (2)		AMPHIBIANS (2)	
Narrow Pigtoe	P1	<i>Procambarus capillatus</i>	P2	River Frog	P1
Southern Sandshell	P1	<i>Procambarus escambiensis</i>	P2	One-toed Amphiuma	P2
Southern Kidneyshell*	P1				
Rayed Creekshell	P2	FISHES (4)		REPTILES (2)	
Fuzzy Pigtoe	P2	Ironcolor Shiner	P1	Rainbow Snake	P2
Choctaw Bean	P2	Gulf Sturgeon	P2	Alligator Snapping Turtle	P2
		Alabama Shad	P2		
		Bluenose Shiner	P2		

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

\*Species marked with an asterisk (\*) are believed to be extirpated from this river basin but still occur in other Alabama river basins.

### Problems Affecting Species/Habitat

- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA1, CA3, CA4, CA6, CA7]
- Habitat degradation and alteration from river dredging operations, desnagging, and drainage of bottomland forests and swamps. [CA1, CA3, CA4, CA6, CA7]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for most GCN species is a major problem. [R1 – R8]
- Introduction of, failure to eradicate or control non-native crayfish. [CA5]
- Construction of new dams within the Yellow River basin would result in loss of riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. [CA1, CA2]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

#### Mussels

- R1. **All GCN species** should be comprehensively surveyed at 2 to 5 year intervals, including investigations of life history requirements, evaluation of population viability and identification of potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Southern Sandshell** – Endemic to Gulf Coast drainages. Conduct an inventory of populations including quantitative assessments to ascertain population viability and

availability of potential fish hosts. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of Southern sandshell; a population viability analysis; identification and GIS mapping of key habitats for possible reintroduction; host fish availability assessment.

- R3. **Southern Kidneyshell** – Conduct extensive surveys to determine if species is still extant in the basin. If found, determine population viability and perform life history studies, including identification of glochidial hosts. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN species, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; population viability analyses; identification of glochidial hosts.
- R4. **Narrow Pigtoe, Rayed Creekshell, Fuzzy Pigtoe, Choctaw Bean** – Conduct a comprehensive inventory and basic life history and ecology studies. Include evaluation of population viability and identification of glochidial hosts and potential reintroduction sites. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN mussels, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; population viability analyses; identification and GIS mapping of key habitats for possible reintroduction; identification of glochidial hosts; host fish population availability assessments.

### Crayfishes

- R5. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of GCN crayfish; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R6. **All GCN Species** – Distribution surveys, life history investigations and long-term quantitative monitoring are need for all species. *Product(s) / Performance measures*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R7. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures*: Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for

possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Amphibians

- R8. **River Frog, One-toed Amphiuma** – Conduct intensive surveys at 3 to 5 year intervals to determine distribution and abundance. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

## Highest Priority Conservation Actions Needed and Key Partnership Opportunities

### All GCN Species

- CA1. Support full implementation of the Choctawhatchee-Pea-Yellow Basins Management *Draft*. *Performance measures*: Number of management plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Construction of new dams within the basin (including downstream in Florida) would be highly detrimental to most GCN species and should be discouraged. *Performance measures*: Number of new dams constructed; number of plans/permits commented on.
- CA3. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, local governments, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

## High Priority Conservation Actions Needed and Key Partnership Opportunities

### Mussels

- CA4. Most species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. The genetic integrity of populations among drainages should be maintained. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition of GCN mussels in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

### Crayfishes

- CA5. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures*: Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

### Fishes

- CA6. **Gulf Sturgeon** – Support designation of critical habitat in the Choctawhatchee, Conecuh and Yellow River basins. *Performance measure*: Designation of such critical habitat.

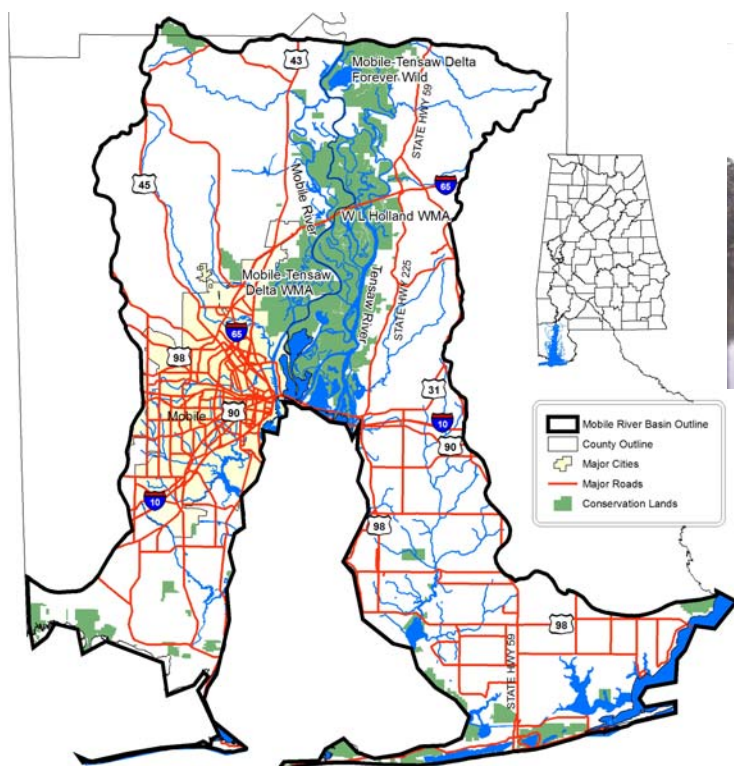
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- CA7. **Bluenose Shiner, Ironcolor Shiner** – Species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition of these GCN fish in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

**Priority Areas for Conservation Action**

- Yellow River and tributaries (including Five Runs Creek)

## Mobile River Basin



Byrnes Lake, Baldwin County *Malcolm Pierson*

### Description and Location

The Mobile River Basin drains an area of more than 40,000 square miles, including much of Alabama and portions of Mississippi, Georgia and Tennessee. For the purposes of this report, Mobile River Basin refers only to the 1,013 square mile portion of the basin downstream of the confluence of the Tombigbee and Alabama Rivers. Included are the Mobile and Tensaw Rivers and the independent drainages of Mobile Bay and adjacent Mississippi Sound, including Fish River, Magnolia River, Fowl River and Bayou La Batre River.

### Condition

The Mobile basin includes a much higher proportion of impaired waters than any other Alabama basin due to urbanization and industrial development associated with Mobile Bay. The 2002 ADEM 303(d) list identifies 211.4 miles of streams that either do not support or only partially support their designated uses. Causes of stream impairment include pathogens, organic enrichment and nutrients. However, more than half of this total is due to mercury contamination of unknown (possible natural) origin. In addition, 540.5 square miles of Mobile Bay, Mississippi Sound, Portersville Bay and Bon Secour Bay are impaired due to pathogens and organic enrichment. Offshore, 238 square miles of the Gulf of Mexico are impaired due to mercury of unknown origin.



TABLE 4-27. GCN SPECIES, MOBILE RIVER BASIN

15 GCN SPECIES include 5 crayfishes, 5 fishes, 2 amphibians, and 3 reptiles.

CRAYFISHES (5)		FISHES (5)		AMPHIBIANS (2)	
Least Crayfish	P2	Alabama Sturgeon	P1	River Frog	P1
<i>Cambarellus leslei</i>	P2	Ironcolor Shiner	P1	One-toed Amphiuma	P2
Rusty Grave Digger	P2	Gulf Sturgeon	P2		
<i>Fallicambarus danielae</i>	P2	Alabama Shad	P2	<b>REPTILES (3)</b>	
<i>Fallicambarus oryctes</i>	P2	Blackmouth Shiner	P2	Alabama Red-bellied Turtle	P1
				Rainbow Snake	P2
				Alligator Snapping Turtle	P2

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

**Major Impoundments** – None

**Land use** – 63% forested, 18% urban, 14% agriculture and pasture

#### Problems Affecting Species/Habitat

- Water quality degradation, particularly pathogens, sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed, and widespread mercury contamination. [CA1, CA2, CA4]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for most GCN species is a major problem. [R1 – R6]
- Introduction of, failure to eradicate or control non-native crayfish. [CA3]
- Vehicle mortality on the U. S. Highway 90 causeway of female and hatchling Alabama red-bellied turtles. [CA5]

#### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

##### Crayfishes

- R1. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

##### Fishes

- R2. **All GCN Species** – Distribution surveys, life history investigations and long-term quantitative monitoring are need for all species. *Product(s) / Performance measures*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions;

knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R3. **Alabama Sturgeon** – Continue efforts to collect adult specimens to produce juveniles for population augmentation of this extremely rare species. *Product(s) / Performance measures:* Establishment of captive population; number of fish propagated and reintroduced.
- R4. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.
- R5. **Blackmouth Shiner** – Resolve taxonomic and distribution problems regarding populations of this species in Alabama, Florida and Mississippi. Conduct an inventory of populations in backwaters and oxbows, including basic life history and ecological studies. *Product(s)/Performance measures:* Data to fill information gaps for mapping abundance and distribution; data to determine genetic and life history differences between the Alabama population and those in Florida and Mississippi.

#### Amphibians

- R6. **River Frog, One-toed Amphiuma** – Conduct intensive surveys at 3 to 5 year intervals to determine distribution and abundance. *Product(s):* Data to fill information gaps for mapping abundance and distribution of these GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Reptiles

- R7. **Alabama Red-bellied Turtle** – Conduct intensive surveys at 3 to 5 year intervals to determine distribution and abundance. Conduct basic life history studies, including identification of habitat and activities of juveniles. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN reptile, allowing identification of needed conservation actions; knowledge of species' life history, biology and habitat requirements to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Mobile Basin Recovery Plan and Coastal Basins Management Plan *Draft*. *Performance measures:* Number of management plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments,**

**Clean Water Partnership and other partners.** *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Crayfishes

CA3. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

#### Fishes

CA4. **Alabama Sturgeon, Ironcolor Shiner** – These species may require population augmentation and/or reintroduction to suitable habitats to maintain their viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners.** *Performance measures:* Population status and condition of these GCN fish in the river basin; if necessary, number of mussels reintroduced or added to suitable habitats; stream miles restored, enhanced, and/or protected by fee-simple or easements.

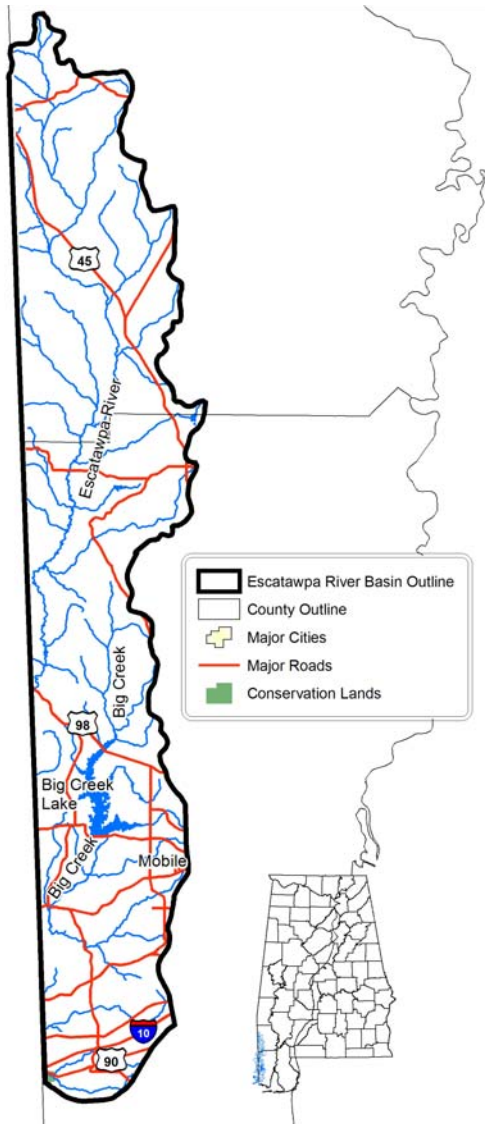
#### Reptiles

CA5. **Alabama Red-bellied Turtle** – The U. S. Highway 90 causeway is a major source of mortality to females and hatchlings, which should be minimized with the use of turtle barriers and other appropriate devices. *Performance measures:* Number and length of turtle barriers or other devices installed.

### Priority Areas for Conservation Action

- Mobile-Tensaw River Delta
- Mobile Bay
- Mississippi Sound
- Portersville Bay

### ***Escatawpa River Basin***



Escatawpa River, Mobile County

*Malcolm Pierson*

### **Description and Location**

The Escatawpa River Basin originates in extreme southwest Alabama and straddles the Alabama-Mississippi state line. The basin covers 1,031 square miles, of which 767 square miles are in Alabama. The Escatawpa is a tributary of the Pascagoula River and drains to Mississippi Sound.

In spite of limited habitat diversity in this small basin, Boschung and Mayden (2004) list 57 freshwater fish species, including two that do not occur in other Alabama drainages.

**TABLE 4-28. GCN SPECIES, ESCATAWPA RIVER BASIN**

12 GCN SPECIES include 3 crayfishes, 4 fishes, 1 amphibian, and 4 reptiles.

**CRAYFISHES (3)**

Least Crayfish P2  
*Fallicambarus danielae* P2  
*Fallicambarus oryctes* P2

**FISHES (4)**

Ironcolor Shiner P1

Brighteye Darter P1  
 Gulf Sturgeon P2  
 Alabama Shad P2

**AMPHIBIANS (1)**

River Frog P1

**REPTILES (4)**

Alabama Red-bellied Turtle P1  
 Rainbow Snake P2  
 Alligator Snapping Turtle P2  
 Razor-backed Musk Turtle P2

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

**Condition**

In Alabama, the upper basin is primarily forested and the lower basin (Big Creek watershed) includes considerable agricultural lands and urban encroachment from the Mobile metropolitan area. The 2002 ADEM 303(d) list identifies 96.6 miles of streams in the Escatawpa basin that either do not support or only partially support their designated uses. Portions of the Escatawpa River and Boggy Branch account for 71.9 miles of this total, due to mercury contamination of unknown (possible natural) origin. In addition, 146.5 square miles of Mississippi Sound are in partial compliance due to pathogens of municipal and industrial origin.

**Major Impoundments** – Big Creek (3,600 acres)

**Land use** – 71% forested, 21% agriculture and pasture, 6% urban

**Problems Affecting Species/Habitat**

- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA1, CA2, CA4]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for most GCN species is a major problem. [R1 – R7]
- Introduction of, failure to eradicate or control non-native crayfish. [CA3]

**Priority Research/Survey/Monitoring Needs**

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

**Crayfishes**

- R1. **All GCN Species** have very limited and poorly documented distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements

and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Fishes

- R2. **All GCN Species** – Distribution surveys, life history investigations and long-term quantitative monitoring are need for all species. *Product(s) / Performance measures:* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R3. **Brighteye Darter** – Alabama distribution limited to Escatawpa basin. Conduct a distribution survey and determine abundance throughout basin. Life history and ecological studies are needed for Alabama population. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of this GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R4. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Amphibians

- R5. **River Frog** – Conduct intensive survey to determine distribution and abundance. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Reptiles

- R6. **All GCN Species** – Distribution surveys, life history investigations and long-term quantitative monitoring are need for all species. *Product(s) / Performance measures:* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN reptiles, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R7. **Alabama Red-bellied Turtle, Razor-backed Musk Turtle** – Conduct intensive surveys at 3 to 5 year intervals to determine distribution and abundance. Conduct basic life history studies, including identification of habitat and activities of juveniles. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of these GCN turtles, allowing identification of



needed conservation actions; knowledge of species' life history, biology and habitat requirements to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

#### All GCN Species

- CA1. Support full implementation of the Coastal Basins Management Plan. *Performance measures:* Number of management plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments, Clean Water Partnership and other partners**. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.

### High Priority Conservation Actions Needed and Key Partnership Opportunities

#### Crayfishes

- CA3. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

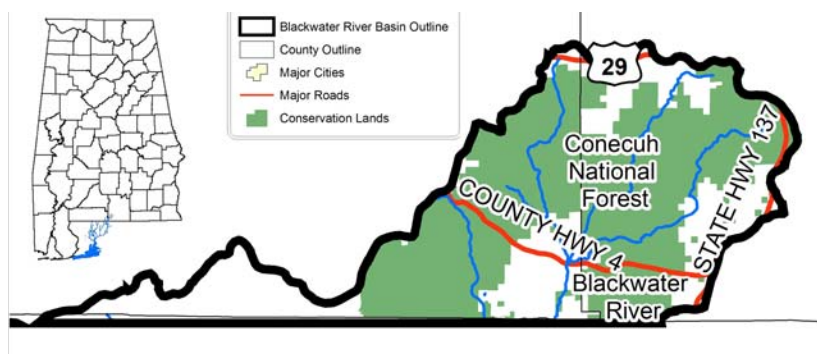
#### Fishes

- CA4. **Ironcolor Shiner** – This species may require population augmentation and/or reintroduction to suitable habitats to maintain viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition; if necessary, number of shiners reintroduced to suitable habitats.

### Priority Areas for Conservation Action

- Escatawpa River
- Buckatunna River tributaries (of the Chickasawhay River)

## Blackwater River Basin



Blackwater Creek, Escambia County  
*Malcolm Pierson*

### Description and Location

The Blackwater River Basin originates in Conecuh National Forest and flows south through the Florida panhandle to Pensacola Bay. This system has small contributions from surface runoff but the primary source of flow is groundwater discharge. Although only 148 square miles of the basins 860 square miles are within Alabama, it provides an important corridor between the Conecuh National Forest and the adjacent 190,000 acre Blackwater River State Forest in Florida.

Boschung and Mayden (2004) identify 84 freshwater fish species native to the Alabama waters draining to Pensacola Bay, primarily the Conecuh basin but also the smaller Yellow and Blackwater basins. For these same waters, Schuster and Taylor (2004) identify 18 crayfish species, representing greater diversity than other Alabama coastal basins (Chattahoochee, Choctawhatchee, Perdido, Escatawpa).

### Condition

Protection afforded this basin by Conecuh National Forest and Blackwater River State Forest result in nearly 50 miles of the river corridor being remote and undeveloped. The Blackwater River is considered one of Florida's most pristine waterways and has been designated an Outstanding Florida Water. Public use facilities include the 31-mile Blackwater River Canoe Trail and Blackwater River State Park. The pristine nature of the Blackwater River and associated recreational facilities make it one of the most popular canoeing streams in Florida. No streams in the Alabama portion of the basin are included in the 2002 ADEM 303(d) list of impaired waters.

**Major Impoundments** – None

**Land Use** – 80% forested, 18% agriculture and pasture

**TABLE 4-29. GCN SPECIES, BLACKWATER RIVER BASIN**

8 GCN SPECIES include 2 crayfishes, 2 fishes, 2 amphibians, and 2 reptiles.

**CRAYFISHES (2)**

<i>Procambarus capillatus</i>	P2
<i>Procambarus escambiensis</i>	P2

**AMPHIBIANS (2)**

River Frog	P1
One-toed Amphiuma	P2

**FISHES (2)**

Ironcolor Shiner	P1
Alabama Shad	P2

**REPTILES (2)**

Rainbow Snake	P2
Alligator Snapping Turtle	P2

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

### Problems Affecting Species/Habitat

- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture and silviculture. [CA1, CA2, CA5]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for many GCN species is a major problem. [R1 – R5]
- Introduction of, failure to eradicate or control non-native crayfish. [CA4]
- Construction of new dams within the Blackwater River basin would result in loss of riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. [CA3]

### Priority Research/Survey/Monitoring Needs

For detailed information on GCN species (except crayfishes) and their conservation actions please see *Alabama Wildlife Volumes 2, 3 and 4* (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.

#### Crayfishes

- R1. **All GCN Species** have very limited and poorly defined distributions. Conduct distribution surveys, determine habitat requirements and life histories, and develop and implement a long-term quantitative monitoring protocol. *Product(s) / Performance measure(s)*: Data to fill information gaps for mapping abundance and distribution of these crayfish ; identification of limiting factors, habitat requirements and/or threats for GCN species population; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Fishes

- R2. **All GCN species** should be comprehensively surveyed at 3 to 5 year intervals, including investigations of life history requirements. *Product(s)*: Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

- R3. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

#### Amphibians

- R4. **All GCN species** should be comprehensively surveyed at 3 to 5 year intervals, including investigations of life history requirements. *Product(s):* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN amphibians, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R5. **River Frog** – Conduct intensive survey to determine distribution and abundance of populations. *Product(s):* Data to fill information gaps for mapping abundance and distribution of this GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

#### Highest Priority Conservation Actions Needed and Key Partnership Opportunities

##### All GCN Species

- CA1. Support full implementation of the Conecuh-Sepulga-Blackwater Rivers Watershed Protection Plan. *Performance measures:* Number of watershed protection plan needs or projects funded or completed; number of project partnerships established; number of cooperative habitat protection projects.
- CA2. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, AFC, NRCS, local governments, Clean Water Partnership and other partners**. *Performance measures:* Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA3. Construction of new dams within the basin (including downstream in Florida) would be highly detrimental to most GCN species and should be discouraged. *Performance measures:* Number of new dams constructed; number of plans/permits commented on.

#### High Priority Conservation Actions Needed and Key Partnership Opportunities

##### Crayfishes

- CA4. **All GCN species** – Interbasin transfer of crayfishes should be avoided under all circumstances because non-native species can rapidly increase in population and aggressively displace native species. *Performance measures:* Population status and condition of native and non-native crayfish in the river basin; number of known interbasin transfers of crayfishes.

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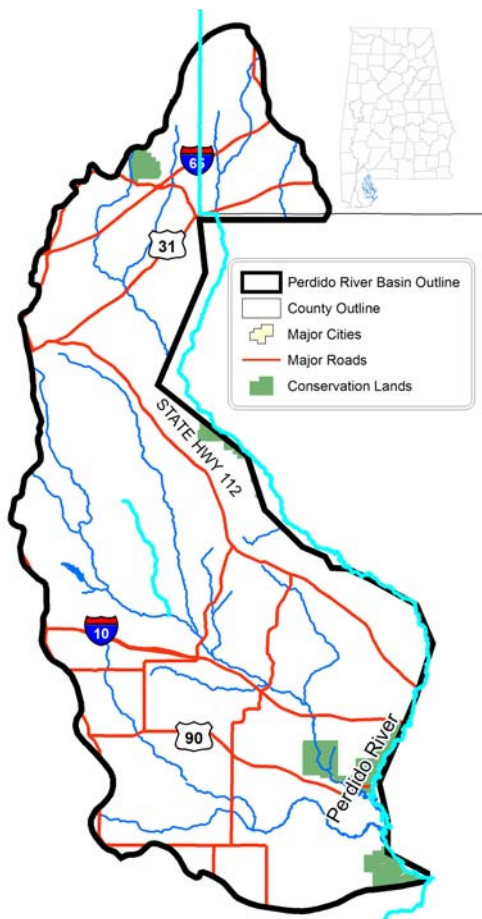
**Fishes**

- CA5. **Ironcolor Shiner** – This species may require population augmentation and/or reintroduction to suitable habitats to maintain viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures:* Population status and condition; if necessary, number of shiners reintroduced to suitable habitats.

**Priority Areas for Conservation Action**

- Blackwater River

## Perdido River Basin



Styx River, Baldwin County

*Malcolm Pierson*

### Description and Location

The Perdido River forms the boundary between the western edge of the Florida panhandle and Alabama. In Alabama, the basin drains 841 square miles of eastern Baldwin County and a small portion of Escambia County.

Boschung and Mayden (2004) identify 58 species of freshwater fishes native to the Perdido basin. The banded sunfish, a species of moderate conservation concern (P3) has been reported in Alabama only from this basin.



**TABLE 4-30. GCN SPECIES, PERDIDO RIVER BASIN**

7 GCN SPECIES include 3 fishes, 2 amphibians, and 2 reptiles.

FISHES (3)		AMPHIBIANS (2)		REPTILES (2)	
Ironcolor Shiner	P1	River Frog	P1	Rainbow Snake	P2
Gulf Sturgeon	P2	One-toed Amphiuma	P2	Alligator Snapping Turtle	P2
Alabama Shad	P2				

P1: Priority 1 – Highest Conservation Concern    P2: Priority 2 – High Conservation Concern

### Condition

The 2002 ADEM 303(d) list identifies 27.1 miles of the Styx River, a Perdido River tributary, as partially supporting designated uses due to mercury contamination of unknown origin.

**Major Impoundments** – None

**Land use** – 69% forested, 19% agriculture and pasture, 7% urban

### Problems Affecting Species/Habitat

- Water quality degradation, particularly sedimentation and nutrient enrichment related to agriculture, silviculture and urbanization of the watershed. [CA1, CA3]
- Habitat degradation and alteration from river dredging operations and drainage of bottomland forests and swamps. [CA1, CA3]
- Lack of knowledge of various aspects of life history and biology, as well as poorly known distribution and status for most GCN species is a major problem. [R1 – R3]
- Construction of new dams within the Perdido River basin would result in loss of riverine habitat, fragmentation and isolation of streams and modification of the natural flow regime. [CA2]

### Priority Research/Survey/Monitoring Needs

*For detailed information on GCN species (except crayfishes) and their conservation actions please see Alabama Wildlife Volumes 2, 3 and 4 (Mirarchi et al. 2004 b, c and d). For information on Alabama crayfishes see Appendix 1-2b.*

#### Fishes

- R1. **All GCN Species** – Distribution surveys, life history investigations and long-term quantitative monitoring are need for all species. *Product(s) / Performance measures:* Data to fill information gaps to determine the abundance, distribution, status and condition of GCN fish, allowing identification of needed conservation actions; knowledge of species' life history and biology to allow land managers, field biologists, and others to make informed decisions; effective monitoring protocols established and implemented; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.
- R2. **Ironcolor Shiner** – Possibly extirpated from Alabama. Conduct a survey to determine if the species is extant. If found, a captive rearing program may be needed to produce juveniles for reintroduction into suitable habitat. *Product(s) / Performance measures:* Data to fill information gaps for mapping abundance and

distribution of this GCN fish; identification and GIS mapping of key habitats for possible reintroduction; if necessary, establishment of a captive propagation program; number of fish propagated and reintroduced.

### Amphibians

- R3. **River Frog, One-toed Amphiuma** – Conduct intensive surveys at 3 to 5 year intervals to determine distribution and abundance. *Product(s)*: Data to fill information gaps for mapping abundance and distribution of these GCN species; inclusion in and/or expansion of the Natural Heritage Database and/or other ADCNR databases/coverages.

## Highest Priority Conservation Actions Needed and Key Partnership Opportunities

### All GCN Species

- CA1. Improve water quality and habitat quality throughout the basin, support habitat and riparian restoration where needed by **ADEM, local governments, Clean Water Partnership and other partners**. *Performance measures*: Stream miles restored, enhanced, and/or protected by fee-simple or easements; ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings; existing monitoring programs utilized/modified to meet CWCS evaluation needs; and new monitoring programs developed.
- CA2. Construction of new dams within the basin would be highly detrimental to most GCN species and should be discouraged. *Performance measures*: Number of new dams constructed; number of plans/permits commented on.

## High Priority Conservation Actions Needed and Key Partnership Opportunities

### Fishes

- CA3. **Ironcolor Shiner** – May require population augmentation and/or reintroduction to suitable habitats to maintain viability. This work should be a cooperative effort of **ARRC, TNARI, USFWS and other partners**. *Performance measures*: Population status and condition; if necessary, number of shiners reintroduced to suitable habitats.

## Priority Areas for Conservation Action

- Perdido River and tributaries (including Styx River, Blackwater River, Dyas Creek)
- Perdido Bay

***Sources of Information for Aquatic Habitats***

- ADEM. 2003a. **Black Warrior River Basin management plan.** Prepared for the Alabama Department of Environmental Management and the Alabama Clean Water Partnership by the Cawaco Resources Conservation and Development Council and basin stakeholders. October 2003. Birmingham, Alabama.
- ADEM. 2003b. **Cahaba River Basin management plan.** Prepared for the Alabama Department of Environmental Management and the Alabama Clean Water Partnership by the Cawaco Resources Conservation and Development Council and basin stakeholders. 2003. Birmingham, Alabama.
- ADEM. 2003c. **Middle Coosa Basin management plan.** Prepared for the Alabama Department of Environmental Management and the Alabama Clean Water Partnership by the Etowah and St. Claire County Soil and Water Conservation Districts and basin stakeholders. August 2003. Gadsden, Alabama.
- ADEM. 2003d. **Tennessee River Basin management plan.** Prepared for the Alabama Department of Environmental Management and the Alabama Clean Water Partnership by the Tennessee Valley Resources Conservation and Development Council and basin stakeholders. May 2003. Decatur, Alabama.
- ADEM. 2004a. **Upper Coosa Basin management plan.** Prepared for the Alabama Department of Environmental Management and the Alabama Clean Water Partnership by the Cherokee County Soil and Water Conservation District basin stakeholders. December 2004. Centre, Alabama.
- ADEM. 2004b. **Coastal River Basin management plan.** Prepared for the Alabama Clean Water Partnership and Alabama Department of Environmental Management by the Mobile County Soil and Water Conservation District and basin stakeholders. January 2004. Mobile, Alabama.
- ADEM. 2004c. **Alabama's 2004 integrated water quality monitoring and assessment report.** 160 pp + appendices.
- ADEM. 2005. **Draft. Alabama-Tombigbee river basins management plan.** Prepared for the Alabama Clean Water Partnership and Alabama Department of Environmental Management by Kleinschmidt Associates and basin stakeholders. February 2005. Montgomery, Alabama.
- ADEM. 2005. **Draft. Lower Coosa Basin management plan.** prepared for the Alabama Clean Water Partnership and Alabama Department of Environmental Management by Delaney Consulting Services, Inc. and basin stakeholders. March 2005. Montgomery, Alabama.

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- CONECUH-SEPULGA CLEAN WATER PARTNERSHIP. 2004. **Conecuh-Sepulga-Blackwater rivers watershed protection plan**. Draft.
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- MCGREGOR, S. W., AND PIERSON, J. M., 1999, **Recent freshwater mussel (Bivalvia: Unionacea) records from the North River system, Fayette and Tuscaloosa counties, Alabama**: Journal of the Alabama Academy of Science, v. 70, no. 4, p. 153-162.
- MCGREGOR, S.W. AND J.T. GARNER. 2004. **Changes in the freshwater mussel (Bivalvia: Unionidae) fauna of the Bear Creek system of northwest Alabama and northeast Mississippi**. American Malacological Bulletin, 18(1) 61-70.
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- U.S. FISH AND WILDLIFE SERVICE. 1992b. **Endangered and threatened wildlife and plants; threatened status for two fish, the goldline darter (*Percina aurolineata*) and blue shiner (*Cyprinella caerulea*).** Federal Register. 57(78) 14786-14790.
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- U.S. FISH AND WILDLIFE SERVICE. 1995a. **Blue shiner (*Cyprinella caerulea*) recovery plan.** USFWS, Jackson, Mississippi.
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- U.S. FISH AND WILDLIFE SERVICE. 1997b. **Recovery plan for palezone shiner (*Notropis albizonatus*).** Atlanta, Georgia.
- U.S. FISH AND WILDLIFE SERVICE. 2000a. **Mobile basin aquatic ecosystem recovery plan.** USFWS Southeast Region, Atlanta, Georgia.
- U.S. FISH AND WILDLIFE SERVICE. 2000b. **Final rule to list the Alabama sturgeon as endangered.** Federal Register 65(88):26438-26461.



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## ***Priority Areas for Conservation***

Chapter 4 to this point has presented individual habitats and river basins as individual units listing threats and recommended actions to conserve them and the GCN species they support. This section views those individual units now as a composite in a holistic statewide landscape scale context. This section takes the biological information on status and distribution of habitats and species and attempts to put them in a geospatial context for conservation, identifying those areas of the state containing these habitats and species that are determined to be in most need of conservation.

The process of identifying priority areas for conservation began with the review of existing relevant plans and programs that have identified such areas or sites in Alabama. Numerous plans and programs exist, but few have identified sites on a statewide scale. Those that have are used here as primary sources, and include *Alabama Wildlife*, Forest Legacy's *Assessment of Need* for Alabama (Boyce et al. 2002) and TNC's "blueprint" for conservation. This CWCS adopted TNC's Priority Areas for Conservation not only because TNC's areas are inclusive of the other areas recognized by other programs such as Forest Legacy, but also because of the process used to identify them:

Over the past six years The Nature Conservancy has worked with public and private partners to design portfolios of conservation areas within and across ecoregions following general principles and specific methods outlined in The Nature Conservancy's *Designing a Geography of Hope* (Groves et al. 2000). Ecoregional portfolios represent the full distribution and diversity of native species, natural communities and ecosystems. The results of the first step in the conservation approach include a portfolio of areas that collectively represent a "blueprint" for biodiversity conservation. This blueprint provides a means to engage different organizations, state and federal agencies, academic institutions, and other partners. Increasingly, detailed information is also being collected to help conservation practitioners develop the most effective, highest leverage approaches to facilitate conservation.

Designing ecoregion-based portfolios is a complex, iterative process based on five steps:

- Identifying the species, communities and ecosystems in an ecoregion;
- Setting specific goals for the number and distribution of these conservation targets to be captured in the portfolio;
- Assembling information and relevant data on the location and quality of conservation targets;
- Designing a network of conservation areas that most effectively meets the goals; and
- Identifying the highest priority conservation areas, wide-ranging targets and pervasive threats for conservation action.

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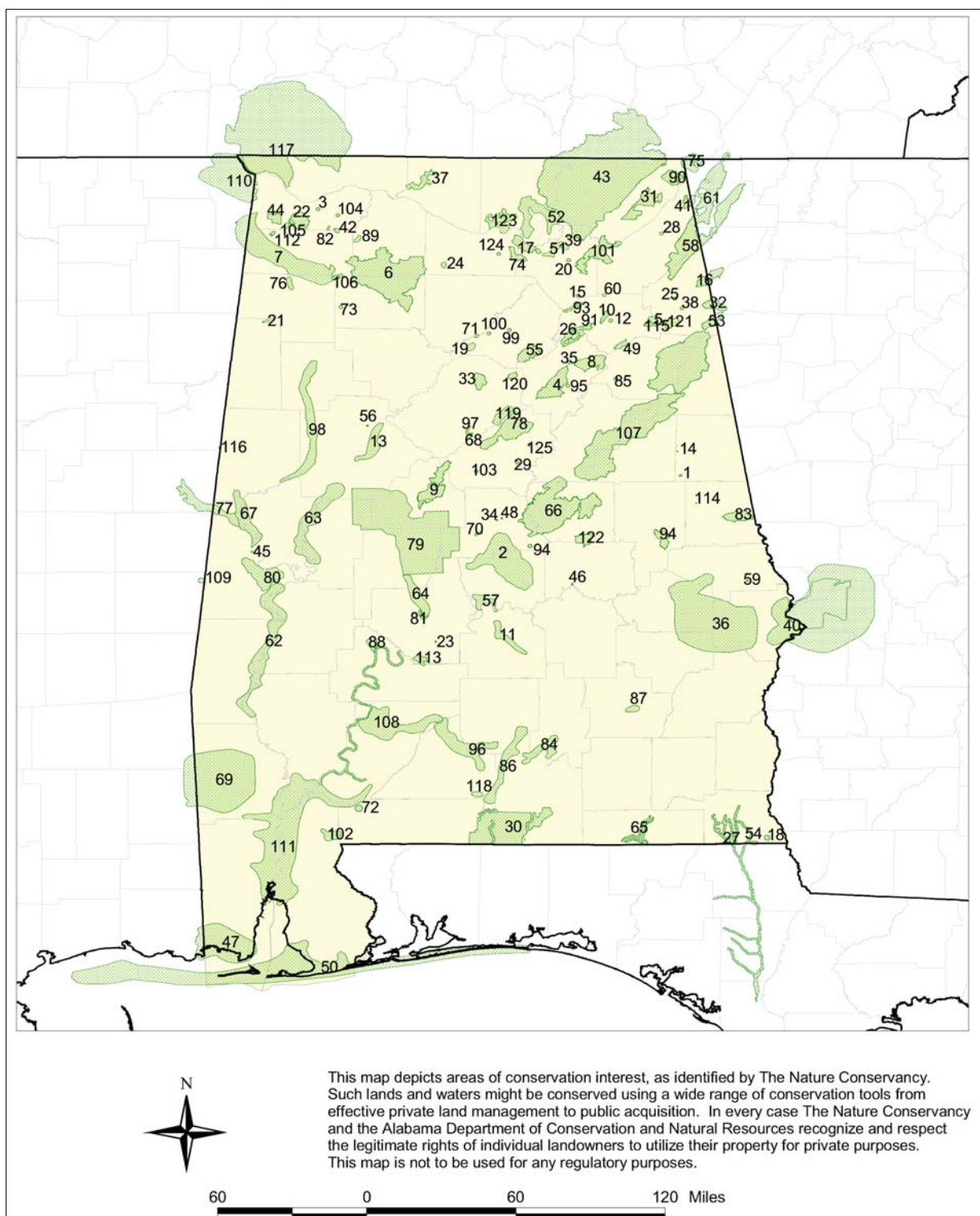
More specifically, for each of the ecoregions that include parts of Alabama, an ecoregional plan was developed with teams of expert biologists from TNC, State Natural Heritage Programs, State Conservation Departments, Tennessee Valley Authority, US Fish & Wildlife Service, US Forest Service, US Geological Survey, Alabama Power Company, academic institutions and other partner organizations that identifies a suite of conservation areas that represent the full distribution and diversity of native species, natural communities and ecosystems. Ecoregions which include portions of Alabama are: the Interior Low Plateaus, the Cumberlands & Southern Ridge & Valley, the Piedmont, the East Gulf Coastal Plain and the Upper East Gulf Coastal Plain. Similar planning processes were followed to identify high priority marine and estuarine sites in the Northern Gulf Of Mexico marine ecoregion, and for freshwater aquatic sites in the Mobile and Tennessee-Cumberland River Basins.

The key components of this general process were as follows:

- Stratify the ecoregion
- Select conservation targets
- Identify target locations
- Set numeric goals
- Assess viability
- Delineate conservation areas
- Identify Data Gaps (throughout)

Separate terrestrial and aquatic teams, engaging in parallel planning efforts, addressed each of these components. The timing and specific approaches of these teams was somewhat different. The bulk of the aquatic assessment was completed under the auspices of a previous project to identify freshwater conservation priority areas in four freshwater ecoregions in the southeastern United States (Smith et al. 2002). These Priority Conservation Areas are presented below in Figures 4-1 and 4-2.

## Chapter 4: Conservation Actions

**Figure 4-1. Priority Areas for Conservation of Terrestrial and Estuarine GCN Species**

## Chapter 4: Conservation Actions

Key to Priority Areas for Conservation of Terrestrial and Estuarine Species, Figure 4-1.

ID	Name	Dry Hardwood Forest	Mesic Hardwood Forest	Wet Pine Flawoods	Floodpl Forest	Dry Longleaf Pine Forest	Swamp	Scrub/Marine Forest	Bog/Seep	Glade/Prairie	Isolated Wetland	Artificial Habitat	Cave/Mine	Beach/Dune	Estuary/Marine	Cliff/Rockhouses
1	Almond Outcrop									x						
2	Autauga Sandhills				x	x			x							
3	Bald Knob	x	x													
4	Bald Rock Mountain	x	x			x				x						
5	Ballplay Swamp	x			x		x			x						
6	Bankhead/Warrior Mountains	x	x		x	x			x	x			x			x
7	Bear Creek Ravines	x	x						x	x						
8	Beaver Creek and School Creek Mountains		x													
9	Bibb County Glades	x	x		x	x			x	x						
10	Big Ridge		x													
11	Big Swamp Creek				x											
12	Black Creek Sandstone Glade		x							x						
13	Black Warrior River Bluffs	x	x													x
14	Blake's Ferry Outcrop									x						
15	Boaz Pond								x		x					
16	Bogan Mountain		x													
17	Brindley Mountain		x													
18	Bryans Creek/Hugh's Bog								x							
19	Bryant Mountain		x													
20	Buck Island Glades									x						
21	Buttahatchee River Slopes		x		x											x
22	Cane Creek/Little Mountain	x	x		x					x	x					x
23	Cedar Creek – Highway 41				x					x						
24	Cedar Plains Glades									x						
25	Centre Bog								x							
26	Chandler Mountain	x	x													
27	Chipola River/Big Creek Woods				x		x									
28	Chitwood Barrens	x							x	x						
29	Columbiana Mountain		x													
30	Conecuh National Forest		x	x	x	x	x		x		x		x			
31	Coon Gulf	x	x							x						
32	Coosa Valley Prairies	x								x						
33	Cunningham Creek Hills	x	x		x											
34	Dillard Bog								x							
35	Dry Creek Barrens								x	x						
36	East Alabama Fall Line Hills		x		x	x	x		x							
37	Elk River Bluffs		x													
38	Ellisville Prairie									x						
39	Fletcher's Hollow		x										x			
40	Fort Benning	x	x		x	x	x		x		x					

## Chapter 4: Conservation Actions

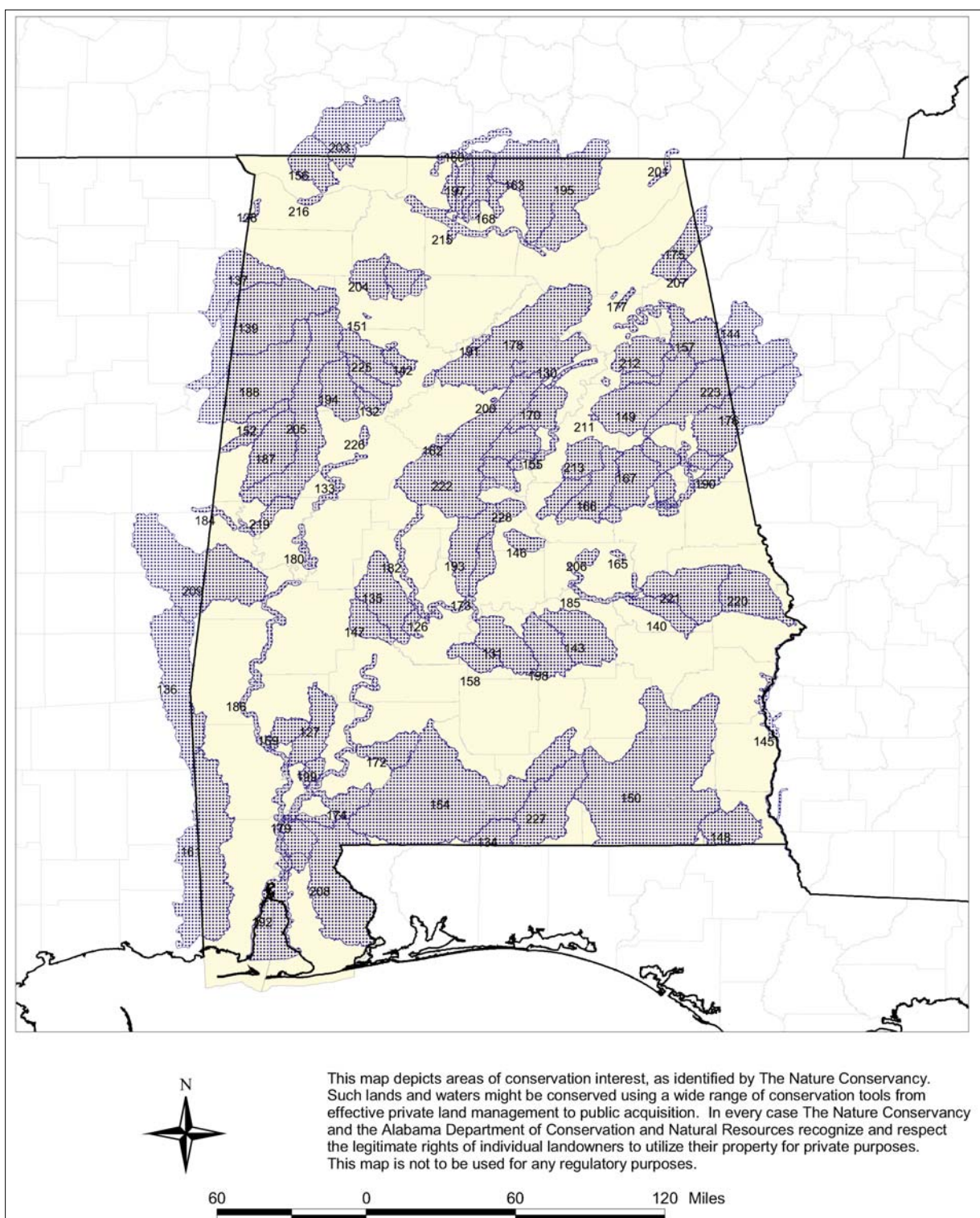
ID	Name	Dry Hardwood Forest	Mesic Hardwood Forest	Wet Pine Flawoods	Floodpl Forest	Dry Longleaf Pine Forest	Swamp	Scrub/Maritime Forest	Bog/Seep	Glade/Prairie	Isolated Wetland	Artificial Habitat	Cave/Mine	Beach/Dune	Estuary/Marine	Cliff/Rockhouses
41	Fox Mountain	x	x													
42	Foxtrap Creek		x		x											x
43	Franklin/Marion/Jackson Mountains	x	x		x				x		x		x			x
44	Freedom Hills and Adjacent Lands	x	x													
45	Ft. Tombecke – Jones Bluff	x								x						
46	Ft. Toulouse – Jackson Park		x				x									
47	Grand Bay Savanna			x	x	x		x	x		x				x	
48	Greens Creek Mountain		x													
49	Green's Pitcher Plant Bog-Yellow Leaf Creek				x				x							
50	Gulf Islands			x		x		x	x					x	x	
51	Honeycomb Creek Karst												x			
52	Huntsville Mountains	x	x						x	x	x		x			x
53	Indian Mountain	x	x													
54	Indigo Pond										x					
55	Inland Lake/Blackburn Fork Woods	x	x													
56	Jock Creek								x							
57	Jones Bluff	x	x							x						
58	Little River Canyon	x	x		x				x	x						x
59	Little Uchee Creek Ravines		x		x											
60	Longleaf Bog								x							
61	Lookout and Pigeon Mountains	x	x						x	x	x		x			x
62	Lower Alabama River Bluffs and Swamps	x	x		x		x		x	x						x
63	Lower Black Warrior Swamps				x		x									
64	Lower Cahaba Bluffs and Swamps		x		x		x									
65	Lower Choctawhatchee River Bluffs		x		x											
66	Lower Hatchet Creek/Coosa WMA	x	x			x										
67	Lower Tombigbee River				x		x									
68	Moss Rock	x	x			x				x						
69	MS-AL Stateline Bogs			x		x			x							
70	Mulberry Creek				x											
71	Mulberry Fork															
72	Mystery Worm Pond										x					
73	Natural Bridge		x													x
74	Newsome Sinks		x										x			x
75	Nickajack Cove		x										x			x
76	North Fork Creek Glade		x							x						x
77	Noxubee Prairies and Forests	x	x		x		x			x						
78	Oak and Double Oak Mountains	x	x			x										
79	Oakmulgee District, Talladega National Forest	x	x		x	x			x							
80	Old Bluffport	x	x							x						
81	Old Cahaba Prairies	x	x							x						
82	Osborne Hill Barrens	x								x						



## Chapter 4: Conservation Actions

ID	Name	Dry Hardwood Forest	Mesic Hardwood Forest	Wet Pine Flawwoods	Floodpl Forest	Dry Longleaf Pine Forest	Swamp	Scrub/Maritime Forest	Bog/Seep	Glade/Prairie	Isolated Wetland	Artificial Habitat	Cave/Mine	Beach/Dune	Estuary/Marine	Cliff/Rockhouses
83	Oseligee Creek	x	x													
84	Patsaliga Creek		x													
85	Pelham Range Prairie	x								x						
86	Persimmon Creek		x													
87	Pike County Pocosin Sandhills	x	x			x										
88	Prairie Bluff – Millers Ferry Prairie				x					x						
89	Prairie Grove Glades	x								x						
90	Raccoon Creek															
91	Red Mountain															
92	Rock Creek Barrens	x								x						
93	Sand Mountain															
94	Sandy Creek	x	x						x							
95	Savages Crossing															
96	Sepulga River Slopes		x		x											
97	Shades Mountain		x													
98	Sipsey River				x		x									
99	Skirum Bluff	x								x						x
100	Skyball Mountain	x	x													
101	South Sauty Creek															
102	Splinter Hill Bog			x	x	x			x							
103	Spring Creek				x				x							
104	Spring Valley	x								x						
105	Srygley Barrens	x								x						
106	Sunny Home Glades	x								x						
107	Talladega Mountains	x	x		x	x			x		x					x
108	Tallahatta Bluffs		x		x	x										x
109	Tamola Mouse Site											x?				
110	Tennessee River Bluffs															
111	Tensaw Delta	x	x	x	x	x	x	x	x							
112	Thorne Glade	x								x						
113	Tilden Carlowville Prairie Complex	x								x						
114	Tiller's Outcrop									x						
115	Tom Cat Prairie	x			x	x										
116	Tombigbee River Levee Old Field Mouse Site											x?				
117	Transition Hills	x	x		x											
118	Turk's Cave		x										x			
119	Upper Cahaba Watershed	x	x			x							x			
120	Upper Gurley Creek	x	x										x			x
121	Weisner Mountain	x	x			x										
122	Weoka Creek															
123	Wheeler NWR / Redstone Arsenal	x	x		x		x			x						x

## Chapter 4: Conservation Actions



**Figure 4-2. Priority Areas for Conservation of Aquatic GCN Species**

## Chapter 4: Conservation Actions

## Key to Priority Areas for Conservation of Aquatic GCN Species, Figure 4-2.

124	Yellow Bluff	178	Locust Fork Black Warrior
125	Yellowleaf Creek Bog	179	Lower Alabama River
126	Alabama River	180	Lower Black Warrior River
127	Bassett Creek	181	Lower Blackwater Creek
128	Bear Creek	182	Lower Cahaba River
129	Beaverdam Swamp	183	Lower Coosa River mainstem
130	Big Canoe Creek	184	Lower Noxubee River
131	Big Swamp Creek	185	Lower Tallapoosa River
132	Big Yellow Creek	186	Lower Tombigbee River
133	Black Warrior River	187	Lubbub Creek
134	Blackwater River	188	Luxapallila Creek
135	Bogue Chitto Creek	189	Manitou Cave
136	Buckatunna River	190	Middle Tallapoosa River and tributaries
137	Bull Mountain Creek	191	Mill Creek
138	Burnt Cane Creek	192	Mobile and Tensaw Rivers/Mobile Bay
139	Buttahatchee River	193	Mulberry Creek
140	Calebee Creek	194	North River
141	Calhoun County Springs	195	Paint Rock River
142	Cane Creek	196	Pine Log Creek
143	Catoma Creek	197	Piney Creek
144	Cedar Creek	198	Pintalla Creek
145	Chattahoochee River	199	Reedy/Little Reedy/Sand Hill Creeks
146	Chestnut Creek	200	Roebuck Spring
147	Chilatchee Creek	201	Sequatchie River/Tennessee River above Guntersville
148	Chipola River	202	Shoal Creek
149	Choccolocco Creek	203	Shoal/Butler Creeks
150	Choctawhatchee / Pea River	204	Sipsey Fork Black Warrior
151	Clear Creek tributary (Bankhead NF)	205	Sipsey River
152	Coal Fire Creek	206	Sofkahatchee Creek
153	Colvin Mountain springs	207	Spring Creek
154	Conecuh / Escambia River	208	Styx / Perdido River Corridor
155	Coosa River below Logan Martin Lake	209	Sucarnoochee River
156	Cypress Creek	210	Swan Creek/Florence Cave Complex
157	Dead River Coosa/Terrapin Creek	211	Talladega Spring
158	Dry Cedar Creek	212	Tallasseehatchee Creek
159	Duck Springs/Little Sand Valley Creek	213	Tallasseehatchee River and springs
160	Elk River	214	Tapawingo Springs
161	Escatawpa River	215	Tennessee below Guntersville
162	Fivemile Creek	216	Tennessee River/top of Pickwick Lake
163	Flint River	217	Thomas Spring
164	Glenn Springs	218	Tombigbee River at Gainesville
165	Gold Branch	219	Trussells Creek
166	Hatchet/Weogufka Creeks	220	Uchee Creek
167	Hillabee Creek	221	Uphapee/Chewacla/Opintlocco Creeks
168	Indian Creek/Kelly Spring	222	Upper Cahaba River
169	Jackson Creek	223	Upper Tallapoosa River
170	Kelley/Yellowleaf/Waxahatchee Creeks	224	White Spring
171	Lake Martin tributary	225	Wolf/Lost Creeks
172	Limestone Creek	226	Yellow Creek
173	Little Mulberry Creek	227	Yellow River
174	Little River (Alabama)	228	Yellowleaf Creek
175	Little River (Coosa)		
176	Little Tallapoosa River		
177	Little Wills Creek		

***Implementing this Strategy and the Importance of Partnering***

Alabama is blessed with the fifth highest wildlife diversity in the nation, but this precious resource is declining and in many cases threatened. This document presents an achievable framework for conservation of Alabama's wildlife. It has laid out a blueprint for which species and habitats need conservation as well as how, who, and where to carry it forward. This will require significant effort, resources and partnerships. Unless an alliance of partners works together for the shared goal of conserving our rich natural heritage resource, future generations of Alabamians will experience a world of diminished wonder and beauty.

Declining species can be brought back with a focused effort, as demonstrated by the recovery in Alabama of not only nongame species such as the bald eagle and American alligator, but also formerly rare game species such as white-tailed deer and wild turkey. Had ADCNR, private landowners, neighboring state wildlife agencies, and other partners not mobilized and invested a tremendous effort in recovering these animals decades ago, they might well be treated as GCN species in this plan for conservation.

This document represents DWFF's approach to the demands of a modern, more ecologically enlightened public for resource managers to expand their scope to address the full array of biodiversity. The task is immense, and while DWFF may be the lead state agency, success will depend on productive partnerships with public and private agencies, landowners, scientists, and others (Element 7). Partners are strongly encouraged to integrate the species, habitats, and priority conservation areas outlined in this document into their own conservation programs.

## Chapter 5. CWCS Monitoring, Evaluation, and Adaptive Management

This CWCS presents the conceptual monitoring framework that will be used to assess the status of the GCN species and habitats as well as monitor the effectiveness of CWCS conservation actions (Element 5). Implementation of this plan through future DWFF and partner operational plans will provide details of those conservation actions and their monitoring plans as they are developed. Alabama's approach identifies existing monitoring efforts and tools currently used by DWFF or its partners to assess GCN species, key habitats and related issues, as listed in the plans and programs in Appendix 5-1. It also recognizes the need for the development of new monitoring tools that better fit this broader, non-traditional systems approach. This thinking reflects the general agreement that the status of diverse natural biological communities is more difficult to quantify and measure than that of single species.

In 2005, a series of meetings and subsequent guidance by IAFWA, Organization of Wildlife Planners (OWP), USFWS, USGS, National Park Service, U.S. Forest Service (USFS), and a variety of federal and state experts and partners developed into a regional and national effort to assist states in clarifying and filling these multi-scale monitoring gaps. This CWCS identifies the need for the development of a more effective monitoring framework to best assess and evaluate the condition of the community components as well as the success of the actions implemented. This need is captured in the form of identified conservation, research, and monitoring actions in Chapter 4 for both aquatic and terrestrial systems that support GCN species. It reflects the need to develop an effective monitoring framework, including identification of appropriate indicators as well as performance measures for each habitat or component in need of assessment and evaluation.

This chapter describes the framework for adapting the conservation actions listed in Chapter 4 to changing conditions and new information, particularly the information derived as the Priority Research, Survey and Monitoring Needs are met. Adaptive management is a useful mechanism that will continually improve Alabama's conservation of GCN species and key habitats by incorporating lessons learned from successful and unsuccessful management actions. Alabama's monitoring strategy uses the CWCS conservation objectives to guide monitoring of GCN species, key habitats, and the results of conservation actions. The performance measures and products described in the previous chapter will provide a feedback loop in which the degree of success of each action will be measured. Monitoring is the critical link in the feedback loop, connecting the implementation of conservation actions with management objectives.

Table 5-1 summarizes the type of evaluation or monitoring action, the planned accomplishment measures, and short and long-term outcomes. Appendix 5-1 summarizes existing monitoring efforts in Alabama acknowledged by this CWCS as overall monitoring mechanisms for these actions and partners. If monitoring is not identified for

a GCN species or species group/taxa, Chapter 4 of this CWCS describes monitoring actions for other species which occupy the same habitats; these recommendations are prioritized to benefit the overall habitat, community, or assemblage, including many other GCN species. In cases where not enough information exists to monitor a species or group, or monitoring protocols have not yet been developed, this need is documented and followed by a conservation action to address that information need. This is true for some taxa groups such as small mammals and invertebrate groups for which standardized protocols need to be developed, and where baseline data do not exist to form the basis of a monitoring protocol. In these cases, these overarching taxa needs are described in Chapter 1 under the appropriate taxa.

Monitoring is to be accomplished at several biological levels including individual species, guilds, or natural communities. Plans for monitoring GCN species and their key habitats are listed under the Priority Research, Survey and Monitoring Needs sections for each habitat in Chapter 4. These monitoring actions are the result of the recommendations from the consensus of experts from the Nongame Conference and taxa committees (Mirarchi 2004, Mirarchi et al. 2004a, b, c) as well as from many existing conservation and recovery plans from partners' programs. Wherever possible this CWCS recommends and supports the full implementation of such partners plans, i.e., USFWS, USFS, PIF Bird Conservation Regions (BCR), Partners in Amphibian and Reptile Conservation (PARC), Bat Conservation International (BCI), NatureServe Systems, Forever Wild Land assessments, etc., that have recommended or identified standardized monitoring actions for regional or national consistency.

For example, the Snowy Plover is a GCN species identified by this CWCS that nests within the Beach and Dune key habitat. The Snowy Plover is ranked as a P1 GCN species, has a state status of S1B, and a global status of G3 (Element 1; Appendix 1-3). Most of the Beach and Dune habitat where the Snowy Plover is found has been heavily altered and is threatened by development, fragmentation, predation, human and vehicle disturbance, and inadequate conservation-related education (Elements 2 and 3). A priority monitoring need for the Snowy Plover is the expansion of nesting surveys beyond public lands in order to determine the nesting status of Snowy Plovers in Alabama (Elements 3 and 5). The anticipated products of fulfilling this monitoring need are data to fill information gaps to assess the status and/or condition of GCN plovers and inclusion in and/or expansion of this species in the ADCNR database and GIS coverages (Elements 1, 3 and 5). These data will also be incorporated into regional and national efforts such as the Breeding Bird Survey, International Shorebird Survey, Gulf Coast Joint Venture, Partners in Flight bird conservation plans, and the U.S. Shorebird Conservation Plan (Element 7). Reciprocally, any updates to these regional and national plans will be incorporated into this CWCS as updates are made available (Element 6).

The Priority Research, Survey and Monitoring Needs sections under each habitat in Chapter 4 recommend the appropriate level of monitoring, whether it be at the species, guild, taxa, or habitat/community level. Within each habitat, the most appropriate level of monitoring has been identified and prioritized by the technical and taxa committees to best monitor that "system" at the appropriate level. The most current scientific



information and opinion was used (Mirarchi 2004, Mirarchi et al. 2004a, b, c) and coordinated with partners to maximize effectiveness. It is not yet known what habitat monitoring framework is needed to consider the best regional and national sampling frameworks. Monitoring frameworks or protocols recommended by TNC, the USFS, USGS or EPA will be evaluated for their applicability to Alabama's habitats.

CWCS monitoring builds on existing monitoring and survey systems and explains how information will be obtained to determine the effectiveness of conservation actions. Table 5-1 and Appendix 5-1 list many of the existing plans and programs that have been developed by local, state, regional, national, or international partners for monitoring these GCN species or their habitat components in Alabama. A comprehensive inventory of other existing monitoring programs and projects conducted by partners, organizations, academic institutions and volunteer networks is needed, and as this information becomes available the monitoring strategy will be adapted to incorporate these efforts. Opportunities for partnership with existing monitoring programs and projects will be investigated and pursued as appropriate. Many actions listed in Chapter 4 utilize existing monitoring actions and plans, which are supported by this CWCS. Existing monitoring and survey systems were used as the foundation from which to gain partner/stakeholder input to identify and develop new additional systems where appropriate.

Alabama's monitoring strategy considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions. Implementation of this CWCS involves monitoring at a variety of geographic scales, including local, state, regional, national, and international, according to their appropriateness and the recommendations of relevant partners' plans and programs. For example, PARC recommends herpetofaunal monitoring with standardized protocols for the southeast region, similar to USFWS and Partners In Flight BCRs and other regional, national and international Bird Plans (i.e., Table 5-1 was adapted from the Atlantic Coast Joint Venture Strategic Plan). As a result, Alabama's monitoring strategy will use the standardized regional protocols for amphibian and reptile monitoring in order to place Alabama's populations in the appropriate context. Other standardized monitoring protocols, such as those of the Breeding Bird Survey, International Shorebird Survey, North American Bat Conservation Partnership Strategic Plan, and American Fisheries Society, will be utilized wherever appropriate so that Alabama's data will be compatible with regional and national conservation efforts.

Alabama's monitoring strategy also incorporates several time scales (short-term, interim and long-term) to monitor the implementation and effectiveness of conservation actions and the status and condition of key habitats. In the short-term, the monitoring strategy is to determine whether conservation actions have been implemented. In the interim, the monitoring strategy seeks to evaluate whether the conservation actions were successful in improving the status and/or condition of GCN species and key habitats – did the conservation actions work as theorized? Long-term objectives of the monitoring strategy are to spatially track the abundance and distribution (both historic and current) of key habitats, their condition and conservation status, and to adaptively manage the desired amount, distribution and condition of each habitat.

The short-term objective of tracking the implementation of conservation actions will be accomplished by using the performance measures outlined in Chapter 4 for each conservation action. Implementation information will be managed in an accomplishment tracking database. The status and trends of individual GCN species will be tracked by adapting the existing SLD-NHP database(s) to include categories for the status of GCN species, research and survey project results, and inventory and monitoring data. A web-based data entry and/or retrieval system will be developed for DWFF staff, researchers and partners, allowing scientific data to be readily shared and disseminated. Other ADCNR databases and coverages will be updated as research, survey and monitoring product information becomes available. These electronic information management mechanisms may be linked with the National Biological Information Infrastructure (NBII) network, or its regional and thematic Information Nodes, to facilitate information sharing at the regional and national levels.

The interim objectives of evaluating the successfulness of conservation actions to improve the status and/or condition of key habitats will be accomplished primarily through existing monitoring programs such as the watershed protection and river basin management plans. The long-term objectives of monitoring the key habitats will be accomplished using existing and new geographic information system (GIS) programs. Utilizing the existing GAP for terrestrial habitats, and adding an aquatic GAP, DWFF will be able to track the status and trends of Alabama's key habitats. Periodic updates of the land use and land cover in the state will allow the abundance and distribution of each habitat to be monitored as conservation actions and SWG projects are implemented. Areas where additional efforts are needed will be identified and adaptively incorporated as the CWCS is updated. Utilizing landscape-level remote sensing and other mapping techniques will be particularly valuable given the proportion of key habitats and GCN species that are located on private lands. Many conservation actions will be incorporated into the GIS tracking system, allowing DWFF to monitor partnerships and public involvement such as conservation easements, stewardship agreements, volunteer monitoring projects, restoration and enhancement projects, and land acquisitions and donations.

This CWCS is adaptive and allows for evaluating conservation actions, responding to changing conditions and implementing new actions and information. In the Snowy Plover example, two priority conservation actions (Element 4) have been identified to improve the conservation of Snowy Plovers and their Beach and Dune nesting habitat: (1) protect all remaining nesting habitat by supporting dune restoration on public and private lands, requiring dune-walkovers at all public and private access points, prohibiting all vehicle access to dune habitats, encouraging the use of native planting and landscaping for all areas, and developing bio-friendly tourism initiatives; and (2) post signs directing the public away from sensitive nesting sites. Key partners to implement these conservation actions are the Mobile Bay NEP, Bon Secour NWR, Gulf State Park, and TNC (Element 7). By monitoring the implementation and degree of success of these conservation actions, ADCNR and its partners will be able to quantify the performance measures for each – the number of acres of habitat protected, the completion and

implementation of a public outreach plan, the number of signs posted annually, and the number of regulatory protections implemented to require dune walkovers and prohibit vehicle traffic on dunes (Element 5). The adaptive management approach will allow ADCNR to not only quantify these performance measures, but also compare the results of the species monitoring to infer whether the conservation actions are improving the number of Snowy Plover nests and/or nest productivity each year (Element 5). If the status and condition of breeding Snowy Plovers shows no significant improvement (Elements 1 and 3), then the conservation actions can be modified to intensify habitat protection measures (Element 4), or target key areas and cooperative projects with partners (Element 7) if funds limit the expansion of the conservation measures. Coordination and dissemination of research and protection results will provide updates to regional and national shorebird efforts and programs. In this way, a feedback loop between monitoring, conservation actions and management objectives will be maintained.

The Southern Pigtoe is an example of how this process works with an aquatic species. This GCN mussel occurs in the Coosa River watershed but believed to be extirpated from the Cahaba River watershed. The Southern Pigtoe is ranked as a P1 GCN species, has a state status of S1, is federally-endangered, and has a global status of G1 (Element 1; Chapter 1). The Coosa River watershed where the Southern Pigtoe is found is the largest and most biologically diverse subwatershed in the Mobile River basin, but it has been significantly altered by six dams impounding the mainstem river in Alabama and is also threatened by degraded water quality (Elements 2 and 3; Chapters 2, 3 and 4). A priority monitoring need for the Southern Pigtoe is to conduct a comprehensive survey in the Cahaba River drainage for potential reintroduction sites (Element 3). The anticipated products of fulfilling this monitoring need are data to fill information gaps to identify and map possible reintroduction sites for this GCN mussel (Elements 1, 2 and 3). These data will also be incorporated into regional and national efforts such as the federal recovery plan for the Southern Pigtoe, the Lower, Middle and Upper Coosa River Basin Management Plans, Cahaba River Basin Management Plan, Mobile Basin Management Plan (Element 7; Chapter 7). Reciprocally, any updates to these regional and national plans will be incorporated into this CWCS as updates are made available (Element 6; Chapter 6).

Priority conservation actions (Element 4; Chapter 4) that have been identified to improve the conservation of Southern Pigtoes and their riverine habitat include: (1) support implementation of more natural flow regimes and full compliance with water quality standards at Coosa River dams; (2) improve water and habitat quality by supporting riparian and habitat restoration projects; (3) supporting the full implementation of the Coosa River Basin Management Plan, federal recovery plan, and other applicable management plans; and (4) population augmentation and/or reintroduction to suitable habitats. Key partners to implement these conservation actions include the APC, ARRC, USFWS, TNARI, ADEM, AFC, NRCS, Clean Water Partnership, Coosa River Basin Initiative, local governments and the Cahaba River Society (Element 7; Chapter 7).

By monitoring the implementation and degree of success of these conservation actions, ADCNR and its partners will be able to quantify the performance measures for each – the number of dams operated with more natural flow regimes; water quality monitoring results; the number of acres of riparian habitat and stream miles restored, enhanced or protected; the number of management and recovery plan needs or projects funded and completed; and the population status of the Southern Pigtoe in the basins (Element 5; Chapter 5). The adaptive management approach will allow ADCNR to not only quantify these performance measures, but also compare the results of the species monitoring to infer whether the conservation actions are improving the Southern Pigtoe population each year (Element 5). If the status and condition of Southern Pigtoes shows no significant improvement (Elements 1 and 3), then the conservation actions can be modified to intensify habitat protection measures (Element 4), or target key areas and cooperative projects with partners (Element 7).

DWFF will, with its partners, regularly review and re-evaluate conservation actions and employ adaptive measures to keep the CWCS a dynamic document on track with the specific, current needs of Alabama's GCN species and their habitats. DWFF will use existing reporting and evaluating mechanisms such as the annual federal reporting, five-year AFA process, and partners' plans' revisions. A database is being developed to track the status of the conservation actions identified in this CWCS in order to facilitate the SWG grant administration process as well as track species/habitat changes and project accomplishments. Periodic workshops and symposia will be scheduled to allow for expert review and reevaluation of species, habitat, threat status and the effectiveness of the actions to date and the expansion of CWCS coverage to new taxa groups. The results of these meetings and scientific updates will be incorporated into each future review and revision of this document.

This process includes the continued input from stakeholders and keeps the public informed of projects and results through annual reports, magazine articles, peer reviewed journals, organization newsletters and web site progress reports. It sets up a process for the biennial review and progress evaluation by the Taxa Committees (taxa experts/peer review) of progress on CWCS projects, and this group will provide biennial recommendations as to any changes needed to better address the conservation needs of or threats to GCN species and habitats. DWFF will consider and integrate these recommendations whenever possible into the next iteration and update of the CWCS.

The effectiveness and adaptability of this document will be measured by the frequency and degree of use and integration into the programs and operations of ADCNR's many programs as well as those of its partners and stakeholders. An effective measure of coordination success will be the degree to which each of these partners integrates these GCN species, habitats and conservation actions into their plans and programs. One example of how this occurred early on in the CWCS process is that of the USFS incorporating the GCN species and habitats into their Forest Plan Revision. To that end, each partner will receive final copies of this CWCS with the request that they incorporate its species and habitats into their programs and collaborate with DWFF to implement the appropriate conservation actions identified in this document. Biannual

updates will be provided to these partners with the request to incorporate new information into their programs and plans.

### ***Criteria for Measuring Success***

Evaluating the successful implementation of the CWCS conservation actions will take several forms. The CWCS planning team has identified distinct success criteria that will allow the DWFF to continually assess the status of each conservation action. The performance outputs will accomplish the CWCS objectives and have quantifiable accomplishment measures, which are outlined in Table 5-1, as adapted from the Atlantic

**TABLE 5-1. EVALUATION OBJECTIVES, PERFORMANCE OUTPUTS AND ANNUAL ACCOMPLISHMENT MEASURES TO ASSESS THE SUCCESS OF THE CWCS CONSERVATION MEASURES. MODIFIED FROM ACJV (2004).**

Objective	Overall Performance Output	Annual Accomplishment Measures
Overall	Habitat conserved for GCN species and key habitats	<ul style="list-style-type: none"> <li>• Acres/stream miles protected by fee-simple</li> <li>• Acres/stream miles protected by easements</li> <li>• Acres/stream miles restored</li> <li>• Acres/stream miles enhanced</li> <li>• Management capabilities improved</li> </ul>
	Biological needs assessment	<ul style="list-style-type: none"> <li>• Biological needs assessment updated</li> </ul>
Biological Planning	Threats assessment	<ul style="list-style-type: none"> <li>• Threats assessment updated</li> </ul>
	Status, trends, limiting factors	<ul style="list-style-type: none"> <li>• GCN species with status, trends and limiting factors assessed</li> </ul>
	Population and habitat objectives	<ul style="list-style-type: none"> <li>• GCN population and key habitat objectives determined/updated</li> <li>• State population and habitat objectives determined/updated</li> </ul>
	Science Advisory Committee	<ul style="list-style-type: none"> <li>• Advisory committee meetings held</li> <li>• Research proposals reviewed/prioritized</li> </ul>
Research	Applied research projects	<ul style="list-style-type: none"> <li>• Annual list updated</li> <li>• Research proposals written, projects funded</li> </ul>
	Conservation planning	<ul style="list-style-type: none"> <li>• Workshops hosted</li> <li>• Conservation plans written or revised</li> <li>• Key habitats with GIS data compiled</li> </ul>
Conservation Design	Conservation tools	<ul style="list-style-type: none"> <li>• Aquatic GAP developed</li> <li>• Terrestrial GAP updated</li> </ul>
	Monitoring programs	<ul style="list-style-type: none"> <li>• Existing monitoring programs utilized/modified to meet CWCS evaluation needs</li> <li>• ADEM water quality monitoring results coordinated with watershed plans and this CWCS annually through meetings, etc.</li> </ul>
Monitoring and Evaluation		

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Objective	Overall Performance Output	Annual Accomplishment Measures
Information Management		<ul style="list-style-type: none"> <li>Monitoring expanded</li> <li>New monitoring programs developed</li> </ul>
	Web-based data	<ul style="list-style-type: none"> <li>Data Web pages developed</li> </ul>
	Accomplishment tracking	<ul style="list-style-type: none"> <li>Accomplishment tracking data entered and available electronically</li> </ul>
	Specific information products	<ul style="list-style-type: none"> <li>Natural Heritage Database updated</li> <li>ADCNR databases/coverages updated</li> </ul>
Project Funding	Priority projects	<ul style="list-style-type: none"> <li>Up-to-date inventory of priority projects maintained</li> </ul>
	Federal grants	<ul style="list-style-type: none"> <li>NAWCA projects submitted, projects approved, acres conserved</li> <li>National Coastal Wetland projects submitted, projects approved, acres conserved</li> <li>Neotropical Migratory Bird Conservation projects submitted, projects approved, acres conserved</li> <li>National Fish and Wildlife Foundation projects submitted, projects approved, acres conserved</li> </ul>
		<ul style="list-style-type: none"> <li>SWG project applications submitted, projects approved, acres/stream miles conserved</li> </ul>
		<ul style="list-style-type: none"> <li>Other programs receiving information/assistance, projects funded, acres/stream miles conserved</li> </ul>
	State Wildlife Grants and other state grants	<ul style="list-style-type: none"> <li>SWG project applications submitted, projects approved, acres/stream miles conserved</li> </ul>
	Other funding programs	<ul style="list-style-type: none"> <li>Other programs receiving information/assistance, projects funded, acres/stream miles conserved</li> </ul>
Partners Outreach	Outreach plan	<ul style="list-style-type: none"> <li>Plan completed or updated</li> </ul>
	Web site	<ul style="list-style-type: none"> <li>Web pages created or updated</li> </ul>
	Newsletter	<ul style="list-style-type: none"> <li>Quarterly electronic newsletter produced</li> </ul>
	Partner meetings and presentations	<ul style="list-style-type: none"> <li>Meetings with and presentations to NGOs, field units of federal agencies, ecosystem teams and others</li> </ul>
Public Outreach	Bleiker Input Plan implemented to target PAIs	<ul style="list-style-type: none"> <li>Objectives met through appropriate outreach techniques employed</li> </ul>
Implement Bleiker CPO Plan	Objective-based Educational products, meetings and events	<ul style="list-style-type: none"> <li>Products produced (e.g., website, website frequent updates, periodic workshops and symposia and resulting publications. Other materials such as: maps and information packets)</li> </ul>

Coast Joint Venture Strategic Plan (ACJV 2004). Annual accomplishment measures include tracking the acres/stream miles of habitat protected or improved through various means (i.e., acquisition, conservation easements, restoration or enhancement), biological assessments of GCN species, research to fill data gaps, monitoring programs, information management, funding of conservation projects, and outreach to partners and the public.



Specific proposed criteria to measure the success of the CWCS conservation actions are measurable to be most effective in evaluating the performance of each action. Success criteria identified by the CWCS Steering Committee include the following:

1. A net increase in the acreage/stream miles of key habitat protected through acquisition, restoration, enhancement and/or creation.
2. A net increase in scientific knowledge of GCN species and key habitats.
3. Successful funding of the highest priority conservation project(s).
4. Successful completion of the highest priority conservation project(s).
5. An increase in partner and public involvement in achieving protection of fish and wildlife resources in Alabama.
6. The removal of threats to GCN species and key habitats through avoidance, minimization and mitigation measures.
7. The long-term reduction in the number of GCN species and threats.

In addition to these measurable criteria, the ability of the conservation actions to address the needs of the fish and wildlife resources of Alabama will be monitored qualitatively. An improvement in the coordination of similar monitoring projects conducted by disparate sources would be one such qualitative measure. Coordination of all the avian monitoring projects, for example, through regional resources such as the Gulf Coast Joint Venture Plan, would enhance the efficiency of each project. This would lead to a qualitative improvement towards successfully implementing the CWCS goals and objectives for avifauna. Another qualitative measure of monitoring success may be the increased involvement of DWFF in other statewide or regional conservation initiatives. By utilizing both quantitative and qualitative success criteria, the DWFF will be responsive to the diverse nature, scope and scale of the CWCS conservation actions.

The effectiveness of the conservation actions to meet the CWCS goals and objectives will be monitored via several reporting and review requirements. First, the DWFF Steering and Technical Committees will annually report on the progress to implement and complete the CWCS conservation actions to the DWFF. Second, the DWFF will report CWCS accomplishments to the USFWS as per SWG funding requirements. The status of implementing the conservation actions will be reviewed annually by DWFF staff and an advisory committee of experts will determine when the success criteria are not being met and adaptive management measures are needed. The DWFF staff and the CWCS Steering and Technical committees will then engage the Taxa committees or other experts/partners to identify appropriate revisions to the conservation actions and implement them as a form of adaptive management. This will be completed as often as necessary, as the effectiveness of the conservation measures will be measured on various time scales depending on their scope and duration, but at a minimum of once per year.

### ***CWCS Plan Review and Revision***

DWFF proposes to complete a comprehensive revision of the CWCS in ten years, and to review, evaluate and update sections annually through the existing Federal Assistance

reporting system and grant administration. Further, a database is being developed through this CWCS process to track each aspect of progress on GCN species and their habitats. Any changes in status will be entered annually, both in the database and spatially. Any progress on addressing threats will be tracked through this relational database. Progress on conservation actions, research, surveys and monitoring will be captured at the end of each project (mostly annually) and will be tracked in the database and spatially through their GIS program. This coordinated database, a new joint effort between DWFF and SLD-NHS, will provide for information tracking, management and dissemination to internal and external partners. The Technical Team is the responsible party for implementing this annual and project-end review and evaluation and will annually report to the SWG Steering Committee.

The USFWS requires establishment of procedures to review the CWCS at intervals not to exceed ten years. DWFF will comprehensively revise this CWCS in 2015. To adequately prepare for this 10-year revision, DWFF will sponsor workshops and symposia as needed and utilize this extensive scientific review and update of GCN species, key habitats, and conservation actions as the foundation for the next CWCS. Committing to such a significant effort indicates that DWFF will continue to involve its many conservation partners and interested stakeholders in the CWCS development.

In the interim, DWFF will utilize both short and long-term iterative, existing mechanisms and processes with built-in review and evaluation to maximize opportunities for both internal and external implementation. Each Division/program has a set operational timeframe for program evaluation and reporting. For example, the existing Federal Assistance process requires annual reporting and review with 5-year AFA work plans and evaluations. The Fisheries and Wildlife Sections of DWFF, as well as most other DWFF agency programs, have annual reporting requirements from their granting federal or other funding source. Annual or project-end results that indicate any changes or new information, including information from periodic review by the Taxa Committees will be integrated into the CWCS for each annual review. The Technical Team is the responsible party for implementing this annual and project-end review and evaluation and will annually report to the SWG Steering Committee.

Perhaps the most efficient and effective outcome of this plan will result from the SWG GCN species, key habitats and priority conservation strategies being actively integrated into the revision processes of DWFF and its many partners' plans and programs (as listed in Appendices 2.1 and 5.1). This integration effort alone produces the ripple effect for conservation efforts across the state, providing a consistent and unified approach for conservation of Alabama's wildlife. Incorporation of GCN species and key habitats into SLD-NHP Heritage Plan will provide focused conservation targets for land acquisition and conservation.

With the completion and annual progress reports to Federal Assistance, an iterative, adaptive process will require the incorporation of results of research, monitoring and surveys that provide for refinement of the priorities and actions of this plan. Each revision of this CWCS document and conservation partners' planning documents should reciprocally integrate the updates of partners' plans. This will ensure that each revision

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includes the most current scientific and administrative information for the key conservation partners in the state and institutionalizes these important coordination and revision efforts.

## Chapter 6. CWCS Coordination

The Alabaman Department of Conservation and Natural Resources could not have conducted the ecological assessment summarized in the previous chapters without the assistance of numerous partners both inside and outside ADCNR. ADCNR coordinated with federal, tribal, state and local partners and stakeholders throughout the development of this CWCS (Element 7). This chapter discusses that coordination, the involvement of the public, and plans to continue working with each as the CWCS is implemented and adaptively managed (Elements 5, 6 and 8). Appendix 6-1 provides a detailed summary of the Citizen Participation by Objective method used to involve stakeholders, and Appendix 6-2 lists the individual partners and stakeholders contacted throughout the CWCS development.

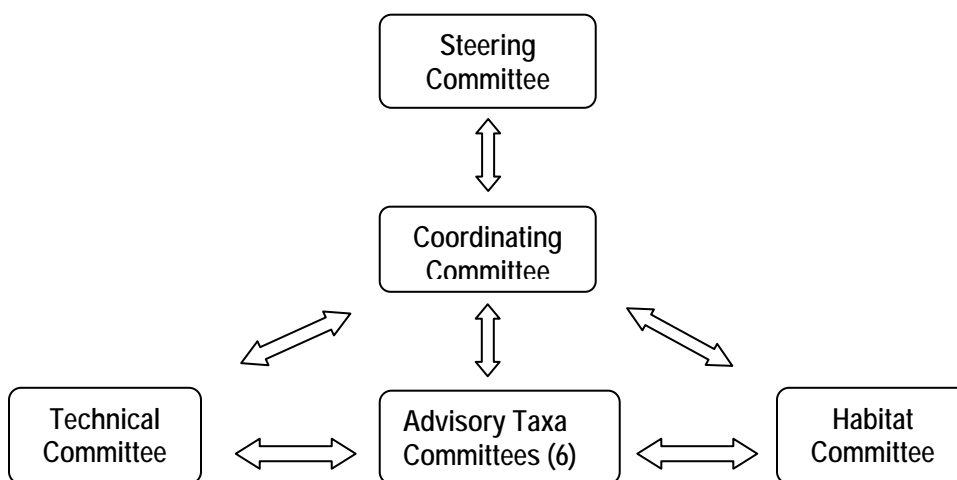
### ***CWCS Organizational Infrastructure***

In order to coordinate with its partners (Element 7) DWFF first had to establish an effective internal SWG administrative framework (see Table 6-1, Figure 6-1). DWFF officially began CWCS development in the summer of 2003 when a Wildlife Diversity Coordinator (WDC) position was established to oversee the SWG program. This position was strategically placed in the Directors office to liaison with Fisheries and Wildlife Sections of DWFF as well as other ADCNR Divisions and staff. DWFF then contracted a consultant to develop the CWCS process and document. A general scope of work was developed to guide the effort, identifying key tasks to be accomplished. Specific guidance provided by the IAFWA and its committees was used to develop the approach throughout the planning process. With this guidance in mind, and with the input of a broadening circle of stakeholders and conservation community (Element 8), Alabama developed its CWCS process approach, providing for general and technical input throughout the process.

A CWCS Steering Committee was formed with key DWFF staff. This committee met with the consultant to compile existing resources and develop the initial timeline and framework for the development of the CWCS. A series of organizational and input solicitation meetings were held to involve first key staff and then all DWFF staff. The effort to obtain input was then expanded through a series of meetings with other ADCNR Divisions, i.e., Marine Resources, State Parks, and SLD-NHS. A Technical Team was established to deal with the substantial technical, scientific data, issues and correspondence with experts and stakeholders consisting of key Non-game staff, the WDC, and contractor.

All levels of DWFF staff were engaged through initial internal SWG/CWCS informational presentations with question/answer sessions and Section meetings and feedback sessions. Additional input was sought individually at informal meetings and follow-up correspondence. DWFF input was then solicited at the program level, where priority setting and conservation needs were discussed. Meetings with each Section were held to inform and update internal staff/partners on GCN species, key habitats, threats

and conservation actions. A Habitat Committee was then established to address the need for external expert input on habitat and ecological communities for the CWCS.



**Figure 6-1. CWCS Organizational Flow Chart**

**TABLE 6-1. ALABAMA CWCS COORDINATING COMMITTEES AND STRUCTURE**

Committee	Members	Role	Meeting
CWCS Steering Committee- Wildlife and Freshwater Fisheries Division	Section Chiefs, Asst. Chiefs, Non-game staff, accountant, WDC, contractor	Initiate and develop process and product, oversee and direct process	Every other month meetings, monthly updates
Technical Committee	Wildlife Section Asst. Chief and Non-game program coordinator, Fisheries Section Asst. Chief and Non-game program coordinator, WDC, contractor	Provide input and feedback on process and species/habitat identification (technical QC)	Every other month meetings, monthly updates
Coordinating Committee	WDC, Contractor staff (3), SLD-NHS database manager	Coordination and progress evaluation (administrative and technical QC)	Monthly during process and priority development, then Quarterly, or as input required
Taxa/Scientific Advisory Committees 6 faunal taxa committees	External experts (=University, Partner Agency and NGO, key Stakeholder participation)	Technical input, scientific evaluation and peer review (technical QC)	Monthly or more frequent
Habitat Committee	External experts (University, Partner Agency and NGO, key Stakeholder participation)	Technical input, scientific evaluation and peer review (technical QC)	Monthly or more frequent

### ***Coordination with Federal, State, Local and Tribal Partners***

Once an internal framework had been established, the coordination effort expanded with **outreach** to major local, state, federal, and tribal partners (Element 7). DWFF inventoried and identified its federal, state, local agency and tribal partners, employed the Bleiker Systematic Development of Informed Consent (SDIC) and Citizen Participation by Objective (CPO) and developed a process to inform, involve, and engage partners throughout the development of the CWCS. These methods helped to identify Potentially Affected Interests (PAI) or stakeholders, the objectives of ADCNR's CWCS process, and the most effective ways to inform stakeholders.

Partners were included in each major phase of the CWCS development and participated in the development of the GCN species and habitat lists and provided and exchanged valuable information and input throughout the document development. Initial contacts with each partner were followed by informal meetings and then continued information exchange. Small, informal focused meetings were held with key local, state, federal and tribal partners around the state to encourage more detailed and more meaningful input during each step (per Bleiker CPO). Initial introductory meetings were held to inform them of the project and solicit input on the CWCS process and recommendations for GCN species and key habitats. Follow up correspondence occurred on a regular basis throughout 2004 to exchange technical information, coordinate activities, and provide updates to keep them informed and involved. Key partners then participated in additional meetings with other partners and tribes in order to present a coordinated approach to wildlife diversity conservation in Alabama. One example was the meeting with the Poarch Band of Creek Indians, where USFWS staff participated and provided information on USFWS programs to further coordinate and plan for the long-term implementation of the CWCS on Tribal Lands. CPO objectives were to share and integrate program information so that the CWCS could be used by partners to help implement their programs, and vice versa.

A key objective agreed upon by these partners was to integrate the results of this CWCS into their plans developed over the next 10 years. This step was taken to insure that there would be maximum CWCS coordination, implementation and buy-in by partners for the next decade. An example of how this will maximize CWCS effectiveness and implementation by partners can be found in the National Forests in Alabama - Resource and Management Plan (USFS 2004). This 10-year plan incorporates the *Alabama Wildlife* priority species (including the CWCS GCN species) and their conservation actions. This step significantly adds to the input process, as the National Forest plans employ a formal public input process and comment period.

Additional federal partners, in the same manner, USFWS Ecological Services, Private Lands Program and NWR staff were also asked to incorporate the GCN species and key habitat conservation targets identified in the CWCS into their programs and plans. Similarly, other key federal partners including Mobile Bay NERES, NRCS, USACOE,



TVA, etc. were all contacted early in the CWCS process and asked to incorporate CWCS targets into their programs and plans. Especially relevant and promising was the synergy and opportunities between CWCS targets and NRCS Farm Bill programs and the TVA and USACOE projects as they impact GCN species and key habitats.

DWFF employed the same approach, as driven by the Bleiker SDIC/CPO process, with all relevant state agency and local partners. CWCS staff met with state agencies including Department of Transportation (ADOT) and Department of Environmental Management (ADEM) to outline specific programs and projects where CWCS should be incorporated. Follow-up exchange of information and updates established a new level of coordination between these agencies and partners. Each partner was informed of the CWCS targets, process, and schedule and was asked to incorporate the CWCS information in to their appropriate programs and plans.

Coordination with the federally recognized tribal partners, the Poarch Band of Creek Indians, consisted of correspondence and meetings that provided information and literature on the SWG state and tribal programs and funding. Coordination included presentation of relevant state and federal programs that might assist the Tribe in wildlife conservation both short and long term as mutually beneficial to GCN species and habitats. Coordination with the USFWS provided for USFWS staff to assist in this effort and resulted in a complementary partnership approach to available programs at both the state and federal levels. Alabama has eight additional state-recognized Tribal Nations: the Cherokee Tribe of Northeast Alabama, Cherokees of Southeast Alabama, Echota Cherokee Tribe of Alabama, Machis Lower Creek Indian Tribe, Mowa Band of Choctaw Indians, Piqua Sept of Ohio Shawnee, Star Clan of Muscogee Creeks, and United Cherokee Ani-Yun-Wiya Nation. These Tribal Nations were given the opportunity to review and comment on the draft CWCS. As partnership opportunities with state-recognized Tribes arise during the implementation stage, DWFF will coordinate with these Tribes on joint conservation projects.

Historically, the 2002 Nongame Conference represented the initial foundation for local, state and federal agencies and tribal involvement in the CWCS process. Participation was solicited at academic and government institutions and invitations were extended to all key local, state and federal entities with programs that significantly affected wildlife conservation in Alabama. Involvement of the Taxa Committees continued through publication of *Alabama Wildlife* in June 2004, the four-volume reference resulting from the Conference. Partners on the Taxa Committees included most of the key state and federal agencies in Alabama, including the USFWS: NWR staff, Ecological Services, Partners; NRCS, USFS, USACOE, NERES, ADEM, SLD-NHP, TVA, ADECA, etc. Therefore, the major stakeholders and partners developed the list of species and conservation recommendations, as DWFF played an oversight role throughout 2002- 2004. This group of partner stakeholders not only identified and ranked all GCN species, but developed conservation actions and detailed accounts for each of the high priority species (Mirarchi et al. 2004a-c). Thus, partner and expert participation has been critical to the process since it began in 2002.

In developing this CWCS, the five Taxa Committees were reengaged to serve the role of External/Expert Peer Review. Each taxa committee consisted of members who represented the key federal and state partners. They were asked to review and update the lists of species and habitats as well as conservation actions. Their technical input and ongoing review and feedback was organized through five separate taxonomic committees (mammals, birds, herps, fish, and invertebrates) throughout 2004. This group of almost 30 members represented a balanced mix of agency partners and stakeholders from a wide variety of Academic Institutions and Conservation Organizations, and provided essential peer review for technical quality control.

In 2004 and early 2005, a sixth taxa group (crayfishes) was integrated into the CWCS development process. First, two experts were contracted to review available information on Alabama crayfishes and provisionally rank each species using the same criteria used for the five other taxa groups in the 2002 Nongame Conference. During a February 2005 crayfishes workshop, ranks were reviewed and GCN species and habitats were identified.

Local, state and federal agencies and tribal partners were asked to review the draft CWCS and their comments were incorporated into the final document. An effective measure of coordination success will be the degree to which each of these partners integrates GCN species, habitats and conservation actions into their plans and programs. One example of how this occurred early on in the CWCS process is that of the USFS incorporating the GCN species and habitats into their Revised Land and Resource Management Plan. To that end, each partner will receive final copies of this CWCS with the request that they incorporate GCN species and habitats and implement the appropriate conservation actions identified in this document.

Contact early in the process focused on informing and engaging these collaborators in the CWCS process, as well as inventorying their existing programs. An assortment of outreach techniques (Bleiker SDIC/CPO) was used to maximize input, including personal contact and correspondence, meetings, topical advisory groups and an interactive website. Relevant target species, habitats and conservation actions from their existing programs were captured, compiled and integrated into the CWCS process. Follow-up correspondence kept them informed of CWCS progress and solicited their additional input and feedback at each major phase of the process. Information on existing programs was reviewed during the process to identify opportunities for collaboration/partnership in the implementation, evaluative review, and adaptive modification of the CWCS.

The CWCS Steering Committee will continue to lead in monitoring the progress of the CWCS implementation and communicating this information with the network of agency and tribal partners involved in the development of the CWCS.

DWFF plans for the continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy. By employing the Bleiker CPO method, an input plan was developed with the major objective of securing partner buy-in and implementation of the document. To address this implementation objective, that message was communicated to each partner and they were asked to support the

implementation of the plan. In addition, DWFF pointed out specific ways the CWCS supported their programs and how the CWCS could be integrated into their plans. Clear examples of how the CWCS GCN species and habitat conservation information could be adapted into and used by their plans were provided in order to maximize implementation of the CWCS. Partners were informed of the review schedule so that this information and their input could be used to revise the plan.

### ***Public and Stakeholder Participation***

DWFF first began its process of involving the public and stakeholders in 2002 with the Nongame Conference (Element 8). This wildlife conference was designed to encourage broad participation of interested publics and stakeholders as they were asked to compile and review existing information on the full array of Alabama's wildlife and identify and recommend priority species deemed to be most in need of conservation. This Conference attracted 240 participants and represented the beginning and foundation for public and stakeholder involvement in the CWCS process. Participation was solicited widely and invitations were extended to all key local, state and federal entities and NGOs. At the same time broad public participation was solicited, academic, private and government institutions that had knowledge, data and programs about wildlife conservation in Alabama were targeted.

As an extension of this effort, a core group of experts and stakeholders were further engaged as taxa committees to develop recommendations for GCN species and habitats. Their continued involvement resulted in a four-volume publication *Alabama Wildlife* (Mirarchi 2004, Mirarchi et al. 2004a, b, c). Members of the taxa committees included representatives of most of the key conservation groups and stakeholders in Alabama, including the Longleaf Alliance, Mobile Bay Estuary Program, TNC, Alabama Natural Heritage Program, Alabama Ornithological Society, TVA, leading universities, state and federal partner agencies, watershed and other coalitions and partnerships.

Therefore, the major stakeholders and partners themselves developed the list of species and conservation recommendations and presented them to DWFF, which played an oversight role throughout 2002-2004. This group of largely external experts and stakeholders not only ranked all species, but identified threats to species and habitats and developed conservation actions (Mirarchi 2004, Mirarchi et al. 2004a, b, c). Thus stakeholder, partner and expert participation was critical to the process since it began in 2002.

This conference therefore provided the foundation for stakeholder and public involvement in the CWCS process. Since then, more general outreach has been in the form of website updates and postings, and mailings to the BAMA Environmental News (BEN) and other widely distributed environmental newsletters. Public participation was solicited and continued at academic and government institutions and many conservation NGOs.

During the active development phase of the CWCS in 2004, the CWCS Steering Committee and contractor worked to actively involve the public at different levels and at each stage of the process (Appendix 6-1). Information on each major public and private program was researched. This resulted in an inventory of all significant existing local, state, and regional/national programs, data sources, tools and information compiled from meetings, correspondence, and research from literature and the Internet (See Appendix 1-1 and 5-1). This pool of knowledge was then used as the foundation for public outreach strategy development.

In January 2004, DWFF developed a public/stakeholder input plan (see Appendices 6-1 and 6-2) and has been actively involving stakeholders through meetings and correspondence, and the public through website and magazine/newsletters/public meetings. The Bleiker CPO process was employed to identify and target the Potentially Affected Interests (PAIs), the specific messages and objectives to be communicated, and the most effective techniques to reach these targeted publics. Worksheets were completed using this method, and the results identified seven highly recommended techniques to employ for the CWCS development and implementation (Appendix 6-1) phases. After the draft CWCS was prepared, a series of meetings was held to solicit input and feedback. The draft was also posted to the DWFF website for public review, and was made available to stakeholders early on for technical review.

For the purposes of this CWCS effort, the "public" was categorized into 3 external tiers:

**Tier 1- Partners/collaborators with significant role/program**

- Key public and private (NGO) conservation groups, such as AFC, AWF, TNC, NS-ALNHP, AOS, TVA, USFS, USFWS
- Leaders/staff/programs that can contribute significant data/scientific knowledge base to be incorporated directly into CWCS
- Leaders/staff/programs that can collaborate on implementation, monitoring and assessment/re-evaluation of the CWCS

**Tier 2- Interested groups and individuals with limited role/program**

- Many NGOs with little or no technical data, such as small private preserves, watershed groups, advocacy groups
- Staff/members with limited/no data/scientific knowledge base that is directly applicable to the CWCS Strategy, but have a potential role in outreach/general input into the development and future implementation of Strategy

**Tier 3- General, uninvolved Public**

- Citizens not directly involved in a Tier 1 or 2 group project
- Able to benefit from the development and implementation of the CWCS as related to economic, recreational and quality of life benefits from effective statewide wildlife conservation

Tier 1 individuals and groups were contacted for input throughout the CWCS development and review process. Regular correspondence and sharing of technical information was critical to assist in the development of the CWCS. Input and feedback from Tier 1 groups was solicited through personal, informal meetings with organization representatives and staff. Per the input plan and CPO techniques, input was solicited at each stage of the project. Expert Committee working meetings and additional follow-up for committee and individual feedback provided “peer review” and refinement during each of the processes of identifying GCN species and key habitats with their associated vegetative communities, of evaluating the most critical problems and threats to species and their habitats, and of selecting and prioritizing effective conservation actions. Use of various programs' existing target species/habitats and recommended conservation strategies were important in focusing existing DWFF programs and projects to benefit from and complement potential collaborative efforts.

Tier 2 and 3 publics (individuals and groups) were informed about the CWCS process and goals. They were kept informed of on-going progress through information posted on the web, articles, and by utilizing their scheduled meetings and newsletters to provide presentations and updates through their existing mechanisms. Input was then solicited from Tier 2 individuals and groups after DWFF staff had sufficiently developed the document to a “Draft” product stage, ready for external review by those interested.

Bleiker's CPO process employed during the development of the CWCS also planned for the continuation of this input and involvement through revision of this CWCS. One important objective identified through the Bleiker CPO was to maintain stakeholder and public involvement through the implementation stage. The various levels of involvement that were solicited from all these groups during strategy development were designed by objective to continue input and feedback from these informed stakeholders/publics during implementation and review of the Strategy. The CWCS and CPO processes were designed to include continued input from stakeholders both short and long-term and to keep these publics informed of SWG projects and results through annual reports, magazine articles, meetings, organization newsletters and web site progress reports. Through these methods of continued coordination and updates, the CWCS process was designed to keep stakeholders and the public informed and involved throughout the implementation stage.

Specific techniques to be utilized during CWCS implementation and review are similar to those identified as most effective during the CWCS development stages. PAIs will be informed and involved through active committee and working meetings, website updates and interaction, and by utilizing existing stakeholder organization meetings and newsletters. Informal meetings with key partners and Tier 1 and 2 stakeholders will be an ongoing, regular part of annual program updates and evaluation.

The general public (Tier 3) and PAIs will be kept informed and educated about the CWCS, its projects and results through a variety of existing public outreach mechanisms. ADCNR recently established a Citizens Conservation Forum that uses the internet to

continually survey the public about conservation issues and concerns. In addition to public website progress reports and educational materials, magazine articles, newsletters, and newspaper articles, public outreach can utilize environmental centers (to host public outreach events on the CWCS, GCN species and habitats, and how ADCNR and its partners are implementing conservation actions to improve Alabama's fish and wildlife resources and their habitats).

Both private and public partners' existing facilities and programs can serve as valuable tools to disseminate conservation education and public outreach materials into classrooms throughout the state. Universities, Labs and other conservation centers undergraduate and graduate programs can integrate CWCS priorities and activities into ongoing and new research and education efforts at the collegiate level. One such example, the Marine and Estuarine Environmental Education Resource Center, has community education and distance learning programs that also provide an opportunity for public outreach on Alabama's wildlife and conservation. The Center is a partnership between the Gulf States Fisheries Management Commission, ADCNR, and several academic institutions, the USDA Cooperative Extension Service, NGOs and local governments. Utilizing this existing partnership to educate the public also involves these partner PAIs.

Outreach to PAIs and the public can also occur through educational booths and displays at the many festivals and events throughout Alabama each year. Existing centers, like the Wehle Nature Center operated by ADCNR provides educational programs, activities and displays that can further citizen's knowledge of GCN species and the key habitats in Alabama. Information about caves, their GCN species and threats can be incorporated into existing tour programs at state parks like Cathedral Caverns. By incorporating information about Alabama's wildlife and state conservation programs into existing environmental education programs, the CWCS will reach a much larger audience and be coordinated with partner agencies and organizations.

Solicitation of input and technical information from expert taxa committees as peer review and evaluation will occur on a biennial basis to provide updates to the ADCNR database and GCN status review. Their expert advice will be consulted regularly during the process of SWG proposal solicitation and selection review. Finally, Tier 1 and 2 stakeholders will be intimately involved in the 10- year revision of this document, as they will continue to play a major role in identifying GCN species and key habitats, as well as updating and identifying new threats and actions for the next decade of CWCS implementation.

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## Acronyms

**List of Acronyms**

ABC	American Bird Conservancy ("Cats Indoors!" Campaign)
ACJV	Atlantic Coast Joint Venture
ACSP	Audubon Cooperative Sanctuary Programs
ACWP	Alabama Clean Water Partnership
ADCNR	Alabama Department of Conservation and Natural Resources
ADECA	Alabama Department of Economic and Community Affairs
ADEM	Alabama Department of Environmental Management
ADOT	Alabama Department of Transportation
AEC	Alabama Electric Cooperative
AFA	Alabama Fisheries Association
AFC	Alabama Forestry Commission
ALIPPC	Alabama Invasive Pest Plant Council
AOS	Alabama Ornithological Society
APC	Alabama Power Company
ARRC	Animal Rescue and Rehabilitation Centre
AWF	Alabama Wildlife Federation
AWW	Alabama Water Watch
BCR	Bird Conservation Region
BEN	BAMA Environmental News
CA	Conservation Action
CFMC	Caribbean Fishery Management Council
CPO	Citizen Participation by Objective
CWCS	Comprehensive Wildlife Conservation Strategy
DIBS	Dauphin Island Bird Sanctuary
DoD	Department of Defense
DWFF	Division of Wildlife and Freshwater Fisheries
EPA	Environmental Protection Agency
FGDC	Federal Geographic Data Committee
FS-SR	Forest Service-Southern Region
GAP	Gap Analysis Program
GCN	Greatest Conservation Need
GIS	Geographic Information System
GMFMC	Gulf of Mexico Fishery Management Council
GSA	Geological Survey of Alabama
IAFWA	International Association of Fish and Wildlife Agencies
IP	Interior Plateau
MBNEP	Mobile Bay National Estuary Program
NS-ALNHP	NatureServe-AlabamaNatural Heritage Program
NABCI	North American Bird Conservation Initiative
NAWCA	North American Wetlands Conservation Act
NAWMP	North American Waterfowl Management Plan

## Acronyms

NBCI	Northern Bobwhite Conservation Initiative
NEFMC	New England Fishery Management Council
NEP	National Estuary Program
NERES	National Estuarine Reserve System
NERR	National Estuarine Research Reserve
NGO	Non-governmental organization
NMEP	National Multimedia Educational Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NVC	National Vegetation Classification
NWR	National Wildlife Refuge
OWP	Organization of Wildlife Planners
P	Piedmont
PAI	Potentially Affected Interests
PARC	Partners for Amphibian and Reptile Conservation
PIF	Partners in Flight
RV	Ridge and Valley
SA	Southwestern Appalachians
SABA	South Alabama Birding Association
SAFMC	South Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SCP	Southern Coastal Plain
SDIC	Systematic Development of Informed Consent
SLD-NHS	State Lands Division Natural Heritage Section
SP	Southeastern Plains
SWG	State Wildlife Grants
TNARI	Tennessee Aquarium Research Institute
TNC	The Nature Conservancy
TVA	Tennessee Valley Authority
TWW	Teaming With Wildlife
USACOE	U.S. Army Corps of Engineers
USACOE (USACE)	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
NAAT	U.S. Fish and Wildlife Service- National Advisory Acceptance Team
USGS	U.S. Geological Survey
WCRP	Wildlife Conservation and Restoration Program
WDC	Wildlife Diversity Coordinator
WMA	Wildlife Management Area

## Appendix 1-1. Local, State, Regional and National Resources

This appendix lists the information sources that were researched, compiled, and reviewed in order to best determine and present the status of the full array of wildlife and its conservation in Alabama. A wide diversity of literature and programs was consulted and compiled through extensive research and coordination efforts. Some of these sources are referenced in the Literature Cited section of this document, and the remaining sources are provided here as a resource for users/implementing parties of this document as well as for future revisions. Sources include published and unpublished data, reports, and correspondence from existing conservation programs:

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
<b>FISH</b>										
Alabama Sport Fish Identification Pocket Guide	Sport Fish	Outdoor Empire Publishing 2000				X				
Alabama Cavefish Recovery Plan	Alabama Cavefish	USFWS 1990	X	X	X	X	X	X	X	X
Boulder Darter Recovery Plan	Boulder Darter	USFWS 1989	X	X	X	X	X	X	X	X
Goldline Darter Recovery Plan	Goldline Darter	USFWS 2000	X	X	X	X	X	X	X	X
Pygmy Sculpin Recovery Plan	Pygmy Sculpin	USFWS 1991	X	X	X	X	X	X	X	X
Slackwater Darter Recovery Plan	Slackwater Darter	USFWS 1984	X	X	X	X	X	X	X	X
Snail Darter Recovery Plan	Snail Darter	USFWS 1983	X	X	X	X	X	X	X	X
Spotfin Chub Recovery Plan	Spotfin Chub	USFWS 1983	X	X	X	X	X	X	X	X
Watercress Darter Recovery Plan	Watercress Darter	USFWS 1993	X	X	X	X	X	X	X	X
Blue Shiner Recovery Plan	Blue shiner	USFWS 1995	X	X	X	X	X	X	X	X
Cahaba Shiner Recovery Plan	Cahaba shiner	USFWS 1992c	X	X	X	X	X	X	X	X
Diversity, Distribution, and Conservation Status of the Native Freshwater Fishes of the Southern United States	Fish	Warren et al. 2000		X	X					
Final Rule to List Alabama Sturgeon as Endangered	Alabama sturgeon	USFWS		X	X	X				

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Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Final Rule to List Vermillion Darter as Endangered	Vermillion darter	USFWS		X	X	X				
Fishes of Alabama	Fish	Boschung and Mayden 2004	X	X	X	X	X	X	X	X
Fishes of Alabama and the Mobile Basin	Fish	GSA, Game and Fish Div. of AL DCNR, and USFWS 1996	X	X	X	X	X	X		
Fishes of North America Endangered, Threatened, or of Special Concern: 1989	Freshwater fish	AFS Williams et al. 1989		X	X	X	X	X	X	X
Gulf Sturgeon Recovery/Management plan	Gulf Sturgeon	USFWS and NMFS 1995	X	X	X	X	X	X	X	X
Marine, estuarine, and diadromous fish stocks at risk of extinction in North America	Fish	AFS Musick et al. 2000		X	X	X	X		X	
Palezone Shiner Recovery Plan	Palezone shiner	USFWS	X	X	X	X	X	X	X	X
Status of U.S. Fisheries – 2001	Marine fish	NOAA 2002		X	X	X	X	X		
Threatened Status for Goldline Darter and Blue Shiner	Goldline darter Blue shiner	USFWS		X		X			X	
Watercress Darter Recovery Plan	Watercress Darter	USFWS	X	X	X	X	X	X	X	X
Red Drum Fishery Management Plan	Red Drum	GMFMC 1986	X	X	X	X	X	X	X	X
Generic Amendment for Addressing Essential Fish Habitat Requirements in the ... Gulf of Mexico	Managed marine fish	GMFMC 1998		X	X	X	X		X	X
Reef Fish Fishery Management Plan	Reef Fish	GMFMC and NMFS 2005	X	X	X	X	X	X	X	X
Fishery Management Plan for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico	Mackerels	GMFMC et al. 2004	X	X	X	X	X	X	X	X
Striped Bass Fishery Management Plan	Striped Bass	GSMFC 1992	X	X	X	X	X	X	X	X
The Striped Mullet Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Striped Mullet	Leard et al. 1993a	X	X	X	X	X	X	X	
The Black Drum Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Black Drum	Leard et al. 1993b	X	X	X	X	X	X	X	

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Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
The Spanish Mackerel Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Spanish Mackerel	Lukens 1989	X	X	X	X	X	X	X	
Atlantic Billfish Fishery Management Plan	Atlantic Billfish	NMFS 1999	X	X	X	X	X	X	X	X
Our Living Oceans: The Status of Habitat for U.S. Living Marine Resources	Marine fish	NMFS 2001		X	X	X		X	X	X
Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks	Atlantic Tunas, Swordfish and Sharks	NMFS 2003	X	X	X	X	X	X	X	X
Striped Bass Fishery Management Plan (Gulf of Mexico)	Striped Bass	Nicholson 1986	X	X	X	X	X	X	X	
The Flounder Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Flounder	VanderKooy 2000	X	X	X	X	X	X	X	
The Spotted Seatrout Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Spotted Seatrout	VanderKooy 2001	X	X	X	X	X	X	X	
The Menhaden Fishery of the Gulf of Mexico, United States: A Regional Management Plan, 2002 Revision	Menhaden	VanderKooy and Smith 2002	X	X	X	X	X	X	X	
<b>BIRDS</b>										
Adaptive Harvest Management: 2003 Duck Hunting Season	Waterfowl	USFWS 2003b		X	X					X
Alabama Birds	Birds	ADCNR Game and Fish Division	X	X	X	X	X	X	X	X
Appalachian Cooperative Grouse Research Project Report. A Summary of Findings From Phase I of the Research Project, 1996-1999	Ruffed grouse	Ruffed Grouse Society Reynolds et al. 2000	X	X	X					
Atlas of Cerulean Warbler Populations	Cerulean warbler	USFWS 2000		X	X					
Bird-habitat Relationships on Southeastern Forest Lands	Birds	USFS		X	X					
Birds of Alabama	Birds	Howel, A.H.	X	X	X	X	X	X	X	X
Birds of Conservation Concern 2002	Birds	USFWS 2002		X	X	X	X	X	X	
Ducks Unlimited's Conservation Plan: Meeting the Annual Life Cycle needs of North America's Waterfowl	Waterfowl	Ducks Unlimited 2001				X	X	X	X	

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Effects of Management Practices on Grassland Birds (series)	Grassland birds	USGS Dechant et al. 2003,	X	X	X	X	X	X	X	X
Expanding the Vision: 1998 Update, North American Waterfowl Management Plan	Waterfowl	USFWS 1999		X	X	X	X	X	X	X
Management Guidelines for Western Snowy Plover	Western Snowy Plover	USFWS 1985		X	X	X	X	X	X	X
Management Recommendations for Marshbirds Summary from the Marshbird Conservation Workshop)	Marshbirds	USFWS 2001		X	?	X	X	X	X	
Mississippi Sandhill Crane Recovery Plan	Sandhill crane	USFWS 1991	X	X	X	X	X	X	X	X
North American Waterfowl Management Plan Update 1998: Expanding the Vision	Waterfowl	USDI 1998		X	X	X	X	X	X	X
Partners in Flight Bird Conservation Plan: Physiographic Area 14: The Interior Low Plateaus	Birds	Partners in Flight Ford et al. 2000		X	X	X	X	X	X	X
Partners in Flight North American Landbird Conservation Plan	Landbirds	Partners In Flight Rich et al. 2003		X	X	X	X	X	X	
Piping Plover ( <i>Charadrius melodus</i> ), Atlantic Coast Population, Revised Recovery Plan	Piping plover	USFWS 1996	X	X	X	X	X	X	X	X
Proposed Rule to Remove Bald Eagle in the lower 48 States from the List of Threatened and Endangered Wildlife	Bald eagle	USFWS 1999								
Recovery Plan for the Red-cockaded Woodpecker	Red-cockaded woodpecker	USFWS 2003	X	X	X	X	X	X	X	X
Review of the Progress on the North American Bird Conservation Initiative	Birds	North American Commission for Environmental Cooperation		X	X	X	X	X	X	
Revised Recovery Plan for U.S. Breeding Population of the Wood Stork	Wood stork	USFWS 1996	X	X	X	X	X	X	X	X
Trends in Duck Breeding Populations, 1955-2003	Waterfowl	USFWS Wilkins and Otto 2003		X	X					
U.S. Shorebird Conservation Plan	Shorebirds	Brown et al. 2001		X	X	X	X	X	X	



## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Waterbird Conservation for the Americas: The North America Waterbird Conservation Plan	Colonial waterbirds	Kushlan et al. 2002		X	X	X	X	X	X	
Waterfowl Population Status 2003	Waterfowl	USFWS 2003a		X	X					
<b>MAMMALS</b>										
A Biological Survey of Alabama	Mammals	USDA, Division of Biological Survey 1921		X	X					
Alabama Beach Mouse Recovery Plan	Alabama beach mouse	USFWS 1987	X	X	X	X	X	X	X	X
Alabama Endangered Bats Cave Survey: Recovery Plan, Priority, and Other Caves	Bats	ADCNR Nongame Wildlife Program 2004	X	X	X	X	X	X	X	X
Alabama Furbearers Status and Harvest Report: 2002-2003	Furbearers	DWFF		X	X					
Bats in Eastern Woodlands	Bats	Bat Conservation International 2001		X	X	X	X	X	X	X
Bats of America	Bats	Barbour 1969	X	X	X	X	X	X	X	X
Biology and Management of White-tailed Deer in Alabama	Deer	DWFF 2003	X	X	X	X	X	X	X	X
Florida Manatee Recovery Plan	Florida manatee	USFWS 1996	X	X	X	X	X	X	X	X
Florida Panther Recovery Plan	Florida Panther	USFWS 1987	X	X	X	X	X	X	X	X
Furbearers of Alabama	Mammals	ADCNR Game and Fish Div. 1989	X	X	X					X
Gray Bat Recovery Plan	Gray bat	USFWS 1982	X	X	X	X	X	X	X	X
Indiana Bat Revised Recovery Plan	Indiana bat	USFWS 1996	X	X	X	X	X	X	X	X
North American Bat Conservation Partnership Strategic Plan	Bats	North American Bat Conservation Partnership 2004								
Red Wolf Recovery Plan	Red Wolf	USFWS 1990	X	X	X	X	X	X	X	X
Walker's Mammals of the World, Volumes 1 and 2	Mammals	Nowak 1991	X	X	X	X				
<b>HERPETOFAUNA</b>										

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Alabama Red-bellied Turtle Recovery Plan	Alabama red-bellied turtle	USFWS 1988	X	X	X	X	X	X	X	X
Conserving Amphibians and Reptiles in the New Millennium	Reptiles and amphibians	PARC 1999				X	X	X	X	X
Eastern Indigo Snake Recovery Plan	Eastern indigo snake	USFWS 1982	X	X	X	X	X	X	X	X
Final Rule to List Flatwoods Salamander as Threatened	Flatwoods salamander	USFWS 1999		X	X	X				
Final Rule to List the Mississippi Gopher Frog Distinct Population Segment of Dusky Gopher Frog as Endangered	Mississippi gopher frog	USFWS 2001		X	X	X				
Flattened Musk Turtle Recovery Plan	Flattened musk turtle	USFWS 1990	X	X	X	X	X	X	X	X
Gopher Tortoise Recovery Plan	Gopher tortoise	USFWS 1990	X	X	X	X	X	X	X	X
Habitat Management Guidelines for Amphibians and Reptiles of the Southeastern United States	Reptiles and amphibians	Bailey et al. 2005				X	X	X	X	X
Habitat Management Guidelines for Amphibians and Reptiles of the Midwestern United States	Reptiles and amphibians	Kingsbury and Gibson 2001				X	X	X	X	X
Land Manager's Guide to the Amphibians and Reptiles of the South	Reptiles and amphibians	TNC 1995		X	X	X	X	X		X
Reclassification of the American Alligator to Threatened due to Similarity of Appearance Throughout the Remainder of its Range	American alligator	USFWS 1987		X	X	X				
Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico	Hawksbill sea turtle	NMFS and USFWS 1993	X	X	X	X	X	X	X	X
Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico	Leatherback sea turtle	NMFS and USFWS 1992	X	X	X	X	X	X	X	X
Recovery Plan for the Kemp's Ridley Sea Turtle ( <i>Lepidochelys kempi</i> )	Kemp's Ridley sea turtle	USFWS and NMFS 1992	X	X	X	X	X	X	X	X
Recovery Plan for U.S. Population of Atlantic Green Turtle	Green sea turtle	NMFS and USFWS 1991a	X	X	X	X	X	X	X	X
Recovery Plan for U.S. Population of Loggerhead Turtle	Loggerhead sea turtle	NMFS and USFWS 1991b	X	X	X	X	X	X	X	X
Red Hills Salamander Recovery Plan	Red Hills salamander	USFWS 1983	X	X	X	X	X	X	X	X

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Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Reptiles in Decline: The Global Decline of Reptiles, Déjà Vu Amphibians	Reptiles	Gibbons et al. 1999		X	X	X	X		X	
The Reptiles and Amphibians of Alabama	Reptiles and amphibians	Mount 1975	X	X	X	X				
<b>INVERTEBRATES</b>										
Recovery plan for five Tombigbee River mussels.	Mussels	USFWS 1989	X	X	X	X	X	X	X	X
Little-wing Pearlymussel recovery plan	Mussels	USFWS 1989	X	X	X	X	X	X	X	X
Cracking Pearlymussel recovery plan	Mussels	USFWS 1990	X	X	X	X	X	X	X	X
Ring Pink Mussel recovery plan	Mussels	USFWS 1991	X	X	X	X	X	X	X	X
Inflated Heelsplitter recovery plan	Mussels	USFWS 1992	X	X	X	X	X	X	X	X
Clubshell and Northern Riffleshell recovery plan	Mussels	USFWS 1994	X	X	X	X	X	X	X	X
Recovery plan for Anthony's Riversnail	Snails	USFWS 1997	X	X	X	X	X	X	X	X
Mobile river basin aquatic ecosystem recovery plan	Mussels, Snails, Fish	USFWS 2000	X	X	X	X	X	X	X	X
Recovery plan for Fat Threeridge, Shinyrayed Pocketbook, Gulf Moccasinshell, Ochlockonee Moccasinshell, Oval Pigtoe, Chipola Slabshell, and Purple Bankclimber	Mussels	USFWS 2003	X	X	X	X	X	X	X	X
Technical/agency draft recovery plan for six Mobile River basin aquatic snails	Snails	USFWS 2004	X	X	X	X	X	X	X	X
Recovery Plan for Cumberland Elktoe, Oyster Mussel, Cumberlandian Combshell, Purple Bean, and Rough Rabbitsfoot	Mussels	USFWS 2004	X	X	X	X	X	X	X	X
A Survey of the Primary Tributaries of the Alabama and Lower Tombigbee Rivers for Freshwater Mussels, Snails, and Crayfish	Mussels, Snails, Crayfish	Geological Survey of Alabama Fitzpatrick et al. 1999		X	X					
American Burying Beetle Recovery Plan	American burying beetle	USFWS 1991	X	X	X	X	X	X	X	X
Caddisflies of Alabama	Caddisflies	Harris et al. 1991	X	X	X	X	X	X	X	

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Catalogue of the Beetles of Alabama	Beetles	Loding 1945								
Conservation Status of Freshwater Mussels of the United States and Canada	Mussels	Williams et al. 1993								
Determination of Endangered Status for the Hine's Emerald Dragonfly	Hine's emerald dragonfly	USFWS 1995	X	X	X	X	X	X	X	X
Endangered Invertebrates: the case for greater attention to invertebrate conservation	Invertebrates	Xerxes Society, Hoffman Black et al. 2001				X	X	X	X	X
Potential Impact of Road-Stream Crossings (Culverts) on the Upstream Passage of Aquatic Macroinvertebrate	Aquatic macroinverts	Xerxes Society, Vaughan 2002	X			X	X		X	X
Southern Appalachian and other Southeastern Streams at Risk: Implications for Mayflies, Dragonflies and Damselflies, Stoneflies, and Caddisflies	Aquatic invertebrates	Southeast Aquatic Research Institute 1997				X	X	X	X	X
Status of Aquatic Mollusks in the Southeastern United States: A Downward Spiral in Diversity	Mollusks	Southeast Aquatic Research Institute 1997		X	X	X	X	X	X	
The Tiger Beetle of Arkansas, Louisiana, and Mississippi	Tiger beetle	Graves and Pearson 1973	X	X	X	X	X	X	X	
The Oyster Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Oyster	Berrigan et al. 1991	X	X	X	X	X	X	X	
The Blue Crab Fishery of the Gulf of Mexico, United States: A Regional Management Plan	Blue crab	Guillory et al. 2001	X	X	X	X	X	X	X	
Stone Crab Fishery Management Plan	Stone Crab	GMFMC 1979	X	X	X	X	X	X	X	X
Shrimp Fishery Management Plan	Shrimp	GMFMC 1981	X	X	X	X	X	X	X	X
Coral and Coral Reefs Fishery Management Plan	Coral and Coral Reefs	GMFMC 1982	X	X	X	X	X	X	X	X
Spiny Lobster Fishery Management Plan	Spiny Lobster	GMFMC and SAFMC 1982	X	X	X	X	X	X	X	X
<b>MULTIPLE SPECIES</b>										
Alabama Inventory List: the Rare, Threatened and Endangered Plants, Animals, and Natural Communities of Alabama	All	NS-ALNHP 2004				X				

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Alabama Wildlife	Vertebrates and invertebrates	DWFF and U. of Alabama Press	X	X	X	X	X	X	X	X
Endangered and Threatened Species Recovery Program: Report to Congress	All	USFWS 1990	X	X	X	X	X	X	X	X
Aquatic Fauna in Peril: the Southeastern Perspective	Aquatic fauna	Benz and Collins 1997				X				
Endangered and Threatened Wildlife and Plants; Animal Notice of Review	Threatened wildlife and plants	USFWS 1989				X				
NatureServe	All species	NatureServe	X	X	X	X	X	X	X	
States of the Union: Ranking America's Biodiversity	All species	NatureServe	X	X	X	X	X	X	X	X
2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation	Wildlife	USFWS and Census Bureau 2003					X		X	
Managing Wildlife on Private Lands in AL and the Southeast	Wildlife	Yarrow and Yarrow 1999	X	X	X	X	X			X
<b>HABITATS</b>										
2000 RPA Assessment of Forest and Range Lands	Forest Range lands	USFS 2000		X	X	X				
A History of Management of Biological Resources of Shelta Cave, Alabama, USA	Shelta Cave	Culver 1999		X						
Alabama Forest Legacy Program; Assessment of Need	Forests	Boyce et al. 2002	X	X	X	X	X	X	X	X
Alabama-Tombigbee River Basins Management Plan	Rivers	ADEM 2005 draft pending	X	X	X	X	X	X	X	X
Black Warrior River Basin Management Plan	Rivers	ADEM 2003a	X	X	X	X	X	X	X	X
Cahaba River Basin Management Plan	Rivers	ADEM 2003b		X	X	X	X	X	X	X
Chattahoochee-Chipola River Basin Management Plan	Rivers	ADEM 2005 draft pending	X	X	X	X	X	X	X	X
Choctawhatchee-Pea-Yellow River Basins Management Plan	Rivers	ADEM 2005 draft pending	X	X	X	X	X	X	X	X
Conecuh-Sepulga-Balckwater Rivers Basin Management Plan	Rivers	ADEM 2004 draft	X	X	X	X	X	X	X	X
Description of the Ecoregions of the United States	Ecoregions	USDA Forest Service 1995	X	X	X	X	X			
Discovering Alabama Wetlands	Wetlands	Phillips 2002		X	X	X				

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Ecological and Behavioral Studies in Shelta Cave, Alabama, with Emphasis on Decapod Crustaceans	Shelta Cave	Cooper 1975		X						
Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems	Terrestrial systems	NatureServe		X	X					
Forest Statistics for Alabama, 2000	Forests	Hartsell 2002	X	X	X	X				
Freshwater Biodiversity Conservation Assessment of the Southeastern United States	Freshwater	Smith et al. 2002		X	X	X	X	X	X	X
Freshwater Ecoregions of North America	Freshwater	Abell et al. 2000	X	X	X	X	X	X		X
International Ecological Classification Standard: Terrestrial Ecological Systems of the United States	Terrestrial	NatureServe 2004		X	X					
Managing the Forest and the Trees; A Private Landowner's Guide to Conservation Management of Longleaf Pine	Longleaf Pine	TNC, Longleaf Alliance, and SGSF	X	X	X	X	X	X		X
Middle Coosa Basin Management Plan	Rivers	ADEM 2003c	X	X	X	X	X	X	X	X
Middle Coosa River, Upper Coosa River, Eightmile Creek, and Cotaco Creek Nonpoint Source Prioritization Project	Rivers and Creeks	Barbour 2004				X	X	X	X	
Mobile Basin Aquatic Ecosystem Recovery Plan	Mobile Basin	USFWS 2000	X	X	X	X	X	X	X	X
Natural Terrestrial Cover Classification; Assumptions and Definitions	Terrestrial	Jennings 1993								
Priority Areas For Freshwater Conservation Action: A Biodiversity Assessment of Southeastern United States	Freshwater	TNC 2002	X	X	X	X	X	X	X	X
Revised Land and Resource Management Plan; National Forests in Alabama	Forests	USDA and FS-SR 2004	X	X	X	X	X	X		X
Rivers of Life: Critical Watersheds for Protecting Freshwater Biodiversity	Watersheds	Master et al. 1998			X	X	X	X	X	
Stewardship of Longleaf Pine Forests: A Guide for Landowners	Longleaf Pine	Longleaf Alliance, Auburn U., and Clemson U. 1997	X	X	X	X	X	X		X

## Appendices

Title	Species or Faunal Group	Source or Reference	Life History	Abundance and Status	Distribution	Threats	Conservation Actions	Monitoring	Research Needs	Adaptive Management
Tallapoosa Basin Management Plan	Rivers	2004 draft	X	X	X	X	X	X	X	X
Tennessee River Basin Management Plan	Rivers	ADEM 2003d	X	X	X	X	X	X	X	X
Coastal River Basin Management Plan	Rivers	ADEM 2004b	X	X	X	X	X	X	X	X
Upper Coosa Basin Watershed Management Plan	Rivers	ADEM 2004a	X	X	X	X	X	X	X	X

**OTHER**

Landscape-Scale Effects of Hydrological Alterations on Riverine Macrobiota in the New World: Tropical--Temperate Comparisons	Pringle 2000
Ecoregions of the Conterminous United States	Omernik 1987
Summary Report on Vegetation Classification Development for USDA Forest Service	NatureServe 2004
100 Years After Cowles: A National Classification for Vegetation	Loucks 1996
Environmental and Organizations Resource Guide	Legacy Inc. 2001
National Vegetation Classification Standard	FGDC 1997
Alabama's 2004 Integrated Water Quality Monitoring and Assessment Report	ADEM 2004c



## Appendix 1-2. Changes from *Alabama Wildlife*

Alabama's Second Nongame Wildlife Conference resulted in the designation of 250 species as either Extirpated, Extirpated/Conservation Action Underway, Priority 1/Highest Conservation Concern or Priority 2/High Conservation Concern. Subsequent changes in GCN status have occurred based on new information for particular species, including the discovery of species previously not known to occur in the state. Changes are detailed below.

### A. Status and Nomenclatural Changes

#### Aquatic Snails ---

*Clappia cahabensis* (Cahaba Pebblesnail) was listed as Extinct in *Alabama Wildlife* but was rediscovered in the Cahaba River by S. Clark. Status changed to P1/Highest Conservation Concern in this document.

*Elimia lachryma* (Teardrop Elimia) was listed as Extinct in *Alabama Wildlife* but was rediscovered in the Coosa River by J. Garner in summer 2004. Status changed to P1/Highest Conservation Concern in this document.

*Elimia vanuxemiana* (Cobble Elimia) was listed as extinct in *Alabama Wildlife* but was rediscovered in the Coosa River by J. Garner in summer 2004. Status changed to P1/Highest Conservation Concern in this document.

*Leptoxis foremani* (Interrupted Rocksnail) is called both *L. foremani* and *L. downiei* in Volumes 1 and 2 of *Alabama Wildlife*. *L. foremani* is used in this document because *L. downiei* was determined to be a synonym of *L. foremani*. The species account appears in *Alabama Wildlife*, Volume 2, page 116 (name misspelled as *L. "formani"*).

*Pyrgulopsis pachyta* (Armored Marstonia) is now *Marstonia pachyta*.

#### Mussels ---

Note: Dr. James Williams, Dr. Arthur Bogan and Mr. Jeff Garner are currently preparing a publication entitled "**The Freshwater Mussels of Alabama and the Mobile Basin of Georgia, Mississippi and Tennessee**" with publication anticipated in 2006. Many of the taxonomic changes to freshwater mussels since the *Alabama Wildlife* volumes were published are the result of extensive work in museum collections as part of the data-gathering process for the publication of this book.

*Alasmidonta triangulata* (Southern Elktoe) was called Extirpated in *Alabama Wildlife* but is now known to be extant in Uchee Creek of the Chattahoochee Basin.

*Epioblasma florentina florentina* (Yellow Blossom) is listed as Extinct in *Alabama Wildlife* but is listed as Extirpated in this document because it is currently unclear if *E. florentina florentina* and *E. florentina walkeri* represent valid subspecies. *E. florentina walkeri* is currently extant in some Tennessee and Cumberland River headwaters.

## Appendices

*Fusconaia burkei* (Tapered Pigtoe) is called *Quincuncina burkei* in *Alabama Wildlife*. Placed in genus *Fusconaia* following genetic analysis (Serb et al. 2003).

*Hamiota altilis* (Finelined Pocketbook) is called *Lampsilis altilis* in *Alabama Wildlife* but has been placed in the genus *Hamiota*. In addition, this species is called Finelined pocketbook in Volume 1 of *Alabama Wildlife* but is called Finerayed pocketbook in Volumes 2 and 4. Finelined pocketbook is used in this document because it is the common name used in Turgeon et al. (1998).

*Hamiota subangulata* (Shinyrayed Pocketbook) is called *Lampsilis subangulata* in *Alabama Wildlife* but has been placed in the genus *Hamiota*.

*Hamiota perovalis* (Orangenacre Mucket) is called *Lampsilis perovalis* in *Alabama Wildlife* but has been placed in the genus *Hamiota*.

*Hamiota perovalis* (Orangenacre Mucket) and *H. altilis* (Finelined Pocketbook) have had their distributions reassigned, pending resolution of their relationships. The former is now considered to occur in the Alabama, Black Warrior, and Tombigbee basins and the latter is in the Alabama, Coosa, Cahaba, and Tallapoosa basins.

*Lasmigona holstonia* (Tennessee Heelsplitter) is attributed to both the Tennessee and Mobile basins in *Alabama Wildlife*. Recent genetic analysis has shown the Mobile Basin (Coosa and Cahaba rivers) form to be a distinct species, *L. etowaensis* (Etowah Heelsplitter).

*Plectomerus sloatianus* (Purple Bankclimber) is called *Elliptiodeus sloatianus* in *Alabama Wildlife*. Placed in genus *Plectomerus* following genetic analysis (Serb et al. 2003).

*Pleuroaia barnesiana* (Tennessee Pigtoe) is called *Fusconaia barnesiana* in *Alabama Wildlife*. Placed in genus *Pleuroaia* based on genetic analysis (Bogan et al. 2004).

*Pleuroaia dolabelloides* (Slabside Pearlymussel) is called *Lexingtonia dolabelloides* in *Alabama Wildlife* but has been placed in the genus *Pleuroaia* based on genetic analysis (Bogan et al. 2004).

*Pleurobema decisum* (Southern Clubshell) and *Pleurobema chattanoogaense* (Painted Clubshell) have been found to be synonyms. Southern Clubshell has precedence and will be used in this document.

*Pleurobema nucleopsis* (Longnut) and *P. georgianum* (Southern Pigtoe) have been found to be synonyms. Southern Pigtoe will be used in this document.

*Pleurobema sp.* is a new species currently being described. It is included in this document as a P1/Highest Conservation Concern species occurring in the Coosa River basin.

*Pleurobema rubellum* (Warrior Pigtoe) is listed as extinct in *Alabama Wildlife*. However, this species has been found to be synonymous with *P. furvum* (Dark Pigtoe), a P1/Highest Conservation Concern, endangered species in *Alabama Wildlife*, with the former name having priority. Therefore, *P. rubellum* is used in this document and its species account is that of *P. furvum* in *Alabama Wildlife*, Volume 2, page 72.

## Appendices

*Potamilus inflatus* is called Inflated Heelsplitter in Volume 1 of *Alabama Wildlife* but called Alabama Heelsplitter in Volumes 2 and 4. Alabama Heelsplitter is used in this document because it is the common name used in Turgeon et al. (1998).

*Ptychobranchus greenii* (Triangular Kidneyshell) is a P1/Highest Conservation Concern, endangered species in *Alabama Wildlife*. Recent preliminary genetic analysis and an evaluation of shell characteristics has shown this to be two species, *P. greenii* and *P. foremanianus* (Rayed Kidneyshell). This document lists *P. greenii* as extant in the Black Warrior and Tombigbee basins and *P. foremanianus* as extant in the Alabama, Cahaba and Coosa basins.

*Quadrula sparsa* (Appalachian monkeyface) was not included in the *Alabama Wildlife* volumes, but archaeological records were recently found of its occurrence at Muscle Shoals and Hobbs Island. It should now be considered Extirpated.

*Villosa fabalis* (Rayed Bean) was not included in *Alabama Wildlife*. However, it is represented by a single prehistoric record from a Tennessee River shell midden in Jackson County and is listed as Extirpated in this document.

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Fishes

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*Acipenser fulvescens* (Lake Sturgeon) was listed as Extirpated in *Alabama Wildlife* but has been reintroduced to the upper Coosa Basin in Georgia and now occurs in Weiss Reservoir. Status changed to Extirpated/Conservation Action Underway in this document.

*Notropis melanostomus* (Blackmouth Shiner) was not included in *Alabama Wildlife*. Discovered in Bay Minette Creek, Baldwin County in April 2003 (J. Williams, personal communication) and since confirmed by other researchers. It is included in this document as a P2/High Conservation Concern species. See species account (Appendix 1-2c).

## **B. Crayfishes of Alabama List**

Adapted from Schuster and Taylor (2004)

### ***Cambarellus diminutus* Hobbs 1945; LEAST CRAYFISH**

**Distribution.** North America: Mobile County, Alabama; George and Jackson counties, Mississippi (Hobbs 1989). Alabama: Known from eight database records, all from Mobile and Washington counties in the Mobile Basin.

**Habitat.** Ditches, pools in sluggish streams (Hobbs 1989)

**Conservation Status.** Priority 2/High Conservation Concern

### ***Cambarellus lesliei* Fitzpatrick and Laning 1976**

**Distribution.** North America: Baldwin, Mobile and Washington counties Alabama; George County Mississippi (Hobbs 1989). Alabama: Known from 17 database records, from Baldwin, Mobile and Washington counties in the Mobile Bay, Tombigbee and Alabama River systems.

**Habitat.** Streams and pools (Hobbs 1989).

**Conservation Status.** Priority 2/High Conservation Concern

### ***Cambarellus shufeldtii* (Faxon 1884); CAJUN DWARF CRAYFISH**

**Distribution.** North America: Alabama, Arkansas, southern Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee (Hobbs 1989). Alabama: Known from nine database records, all from Mobile County in the Mobile Basin.

**Habitat.** Ditches, marshes, swamps, lakes, ponds, and sluggish streams (Hobbs 1989).

**Conservation Status.** Priority 3/Moderate Conservation Concern

### ***Cambarus acanthura* Hobbs 1981**

**Distribution.** North America: Alabama, Georgia and Tennessee (Hobbs 1989). Alabama: Tennessee, Tombigbee, Black Warrior, Alabama, Cahaba, Coosa, Pascagoula, Perdido, Escambia, and Chattahoochee river systems.

**Habitat.** Primary and secondary burrower (Hobbs 1989)

**Conservation Status.** Priority 5/Lowest Conservation Concern

### ***Cambarus bartonii cavatus* (Fabricius 1798); APPALACHIAN BROOK CRAYFISH**

**Distribution.** North America: New Brunswick, Canada west to Kentucky and Tennessee, south to Alabama, Georgia and South Carolina and east to the Atlantic Ocean (Hobbs 1989). Alabama: Known only from two database records from the Chattahoochee River system.

**Habitat.** First and second order streams under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

### ***Cambarus coosae* Hobbs 1981**

**Distribution.** North America: Restricted to the Coosa River system in Georgia and Tennessee and south into Alabama (Hobbs 1989). Alabama: Mobile, Alabama, Cahaba, and Coosa river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 5/Lowest Conservation Concern

### ***Cambarus cracens* Bouchard and Hobbs 1976**

**Distribution.** North America: Known only from Alabama (Hobbs 1989). Alabama: Described from the Tennessee River system; questionable database records from the Black Warrior, Coosa and Tallapoosa river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

## Appendices

***Cambarus diogenes* Girard 1852; DEVIL CRAWFISH**

**Distribution.** North America: Extremely widespread; from the Rockies to southern Canada to New Jersey and throughout the Mississippi River basin (Hobbs 1989). Alabama: Known from all river systems in Alabama, except the Cahaba, Pascagoula and Perdido river systems.

**Habitat.** Secondary and primary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Cambarus distans* Rhoades 1944; BOXCLAW CRAYFISH**

**Distribution.** North America: Cumberland and Tennessee river systems in Alabama, Georgia, Kentucky and Tennessee (Hobbs 1989). Alabama: Known only from three database records from the Tennessee River system.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Cambarus englishi* Hobbs and Hall 1972**

**Distribution.** North America: Endemic to the Tallapoosa River system in Alabama and Georgia (Hobbs 1989). Alabama: Restricted to the Tallapoosa River system, and known from 16 database records.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus girardianus* Faxon 1884**

**Distribution.** North America: Tennessee River system in Alabama, Georgia, Mississippi, and Tennessee; specimens from the Coosa River system in Alabama may be referable to this species (Hobbs 1989). Alabama: Known from the Tennessee River system; database records also from the Mobile, Cahaba and Coosa river systems, however, these records may represent an undescribed taxon.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Cambarus graysoni* Faxon 1914; TWOSPOT CRAYFISH**

**Distribution.** North America: Nashville Basin, Highland Rim and western edge of the Cumberland Plateau in Alabama, Kentucky and Tennessee. Alabama: Known only from six database records from the Tennessee River system.

**Habitat.** Streams under rocks; secondary burrower.

**Conservation Status.** Priority 4/Low Conservation Concern

***Cambarus halli* Hobbs 1968**

**Distribution.** North America: Thought to have been endemic to the Tallapoosa River system in Alabama and Georgia (Hobbs 1989). Alabama: Known from the Tallapoosa River system; questionable database records exist from the Tennessee, Alabama, Cahaba and Coosa river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus hamulatus* (Cope 1881)**

**Distribution.** North America: Tennessee River system, Alabama. Alabama: Known from 20 database records from Blount, Jackson and Marshall counties. Thought to have been restricted to caves in the Tennessee River system in Alabama; one questionable database record from the Black Warrior River system.

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus howardi* Hobbs and Hall 1969**

**Distribution.** North America: Chattahoochee River system in Alabama and Georgia. Alabama: Known only from nine database records from the Chattahoochee River system.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

## Appendices

***Cambarus jonesi* Hobbs and Barr 1960; ALABAMA CAVE CRAYFISH**

**Distribution.** North America: Caves in the Tennessee River system in Alabama (Hobbs 1989). Alabama: Known only from eight database records from caves in the Tennessee River system between Florence and Guntersville (Hobbs 1989).

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus latimanus* LeConte 1856**

**Distribution.** North America: Alabama, Florida, Georgia and North Carolina (Hobbs 1989). Alabama: Reported from all river systems, except the Mobile, Pascagoula and Perdido river systems.

**Habitat.** Streams under rocks; secondary burrower.

**Conservation Status.** Priority 5/Lowest Conservation concern

***Cambarus longirostris* Faxon 1885**

**Distribution.** North America: Tennessee River system in Georgia, Tennessee and North Carolina and introduced into South Carolina (Hobbs 1989); also known from Alabama. Alabama: Known from a total of 18 database records from the Tennessee River system in northern Alabama, and from the Coosa River system. There may be taxonomic issues with this taxon.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Cambarus ludovicianus* Faxon 1884; PAINTED DEVIL CRAYFISH**

**Distribution.** North America: Mississippi River system in Arkansas, Louisiana, Mississippi, and Tennessee, also known from eastern Texas (Hobbs 1989); in addition it has been reported from Alabama (Taylor et al. 1996) and Kentucky (Taylor and Schuster 2004). Alabama: Known from nine database records from the Tombigbee, Alabama and Mobile river systems in Greene, Montgomery, Pickens and Washington counties.

**Habitat.** Secondary and primary burrower.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Cambarus manningi* Hobbs 1981**

**Distribution.** North America: Endemic to the Coosa River system in Alabama, Georgia and Tennessee. Alabama: Known from 11 database records from the Coosa River system.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 4/Low Conservation Concern

***Cambarus militus* Fitzpatrick 1978; RUSTY GRAVE DIGGER**

**Distribution.** North America: Alabama and Florida (Taylor et al. 1996). Alabama: Known only from six database records from near the type locality in Baldwin County. Alabama Heritage Program has two records from Covington County. It is unknown who identified these specimens. They also indicate records from Corn Branch and Negro Creek in Baldwin County from work done by Fitzpatrick (1991). Fitzpatrick considered these possible records, since no form I males were collected to certify identification.

**Habitat.** Primary burrower.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus obstipus* Hall 1959**

**Distribution.** North America: Thought to have been endemic to the Black Warrior River system in Alabama (Hobbs 1989). Alabama: Black Warrior River system; in addition, database records exist for the Tombigbee, Alabama, and Cahaba river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 5/Lowest Conservation Concern

## Appendices

***Cambarus rusticiformis* Rhoades 1944; DEPRESSION CRAYFISH**

**Distribution.** North America: Cumberland and Green rivers in Kentucky and Tennessee and Ohio River in southern Illinois (Hobbs 1989); one record from the Tennessee River system in Alabama. Alabama: Known only from a single record from the Paint Rock River drainage within the Tennessee River system. Bouchard considered this record to be a possible introduction.

**Habitat.** Streams in depressions under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Cambarus scotti* Hobbs 1981**

**Distribution.** North America: Endemic to the upper Coosa River system in Alabama and the Chattooga River system in Georgia (Hobbs 1989). Alabama: Known only from nine database records all from the upper Coosa River system (Chattooga River).

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus striatus* Hay 1902; AMBIGUOUS CRAYFISH**

**Distribution.** North America: Florida, Georgia, South Carolina westward to Mississippi and north to Kentucky (Hobbs 1989). Alabama: Known from the Tennessee, Mobile, Tombigbee, Black Warrior, Cahaba, Coosa, Tallapoosa, Escambia, and Chattahoochee river systems.

**Habitat.** Streams under rocks; also can be primary or secondary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Cambarus tenebrosus* Hay 1902; CAVESPRING CRAYFISH**

**Distribution.** North America: From Illinois south to Alabama (Hobbs 1989). Alabama: Known only from the Tennessee River system.

**Habitat.** Cool water springs and streams under rocks; often found in caves.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Cambarus unestami* Hobbs and Hall 1969**

**Distribution.** North America: Tennessee River system in Georgia and Alabama; also known from the Little River system of the upper Coosa River in Georgia (Hobbs 1989). Alabama: Known only from two database records from the Tennessee River system in Jackson County, Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

***Cambarus veitchorum* Cooper and Cooper 1997a; WHITE SPRING CAVE CRAYFISH**

**Distribution.** North America: Only known from Alabama. Alabama: Endemic to White Spring Cave, Tennessee River system, Limestone County, Alabama (Cooper and Cooper 1997a).

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 1/Highest Conservation Concern

***Cambarus* sp. A**

**Distribution.** North America: Jezerinac (1993) indicated that this undescribed species ranged from southern Michigan, western Ohio, Indiana, most of Illinois, western Kentucky west to eastern Missouri and south to the Gulf of Mexico in Mississippi, Alabama and far western Florida. Alabama: It is unclear what the exact distribution of this species is in Alabama.

**Habitat.** Secondary and primary burrower.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Fallicambarus burrisi* Fitzpatrick 1987**

**Distribution.** North America: Chickasawhay and Escatawpa river systems in Alabama and Mississippi. Alabama: Known only from two database records from the Escatawpa River system in southwestern Alabama.

**Habitat.** Primary burrower in *Sarracenia* bogs.



## Appendices

Conservation Status. Priority 2/High Conservation Concern

***Fallicambarus byersi* (Hobbs 1941); LAVENDER BURROWING CRAYFISH**

**Distribution.** North America: Okaloosa County, Florida, west to Bay St. Louis, Hancock County Mississippi. Alabama: Known from 17 database records from the Tombigbee, Alabama, Pascagoula, and Escatawpa river systems.

**Habitat.** Primary Burrower.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Fallicambarus danielae* Hobbs 1975**

**Distribution.** North America: Known only southern Mississippi and southwestern Alabama. Alabama: Known from only four database records from the Mobile and Pascagoula river systems.

**Habitat.** Primary burrower.

**Conservation Status.** Priority 2/High Conservation Concern

***Fallicambarus fodiens* (Cottle 1863); DIGGER CRAYFISH**

**Distribution.** North America: Southern Ontario, Michigan, Ohio, Indiana, and Illinois south to Arkansas, Mississippi, and Alabama (Hobbs 1989). Alabama: Known from 17 database records from the Tennessee, Tombigbee and Alabama river systems.

**Habitat.** Primary and secondary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Fallicambarus oryctes* (Penn and Marlow 1959)**

**Distribution.** North America: Southern Louisiana to southern Alabama (Hobbs 1989). Alabama: Known only from three database records from Baldwin and Mobile counties.

**Habitat.** Primary burrower

**Conservation Status.** Priority 2/High Conservation Concern

***Faxonella clypeata* (Hay 1899); DITCH FENCING CRAYFISH**

**Distribution.** North America: Oklahoma and Texas east to Florida and north to South Carolina. Alabama: Known from 17 database records from the Mobile, Tombigbee, Alabama, Tallapoosa, Pascagoula, Escatawpa, Choctawhatchee, and Chattahoochee river systems (Hobbs 1989).

**Habitat.** Slow streams, marshes, swamps and ditches; tertiary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Hobbseus prominens* (Hobbs 1966a)**

**Distribution.** North America: Mobile River Basin in Alabama; northern Mississippi (Hobbs 1989). Alabama: Known from 18 database records from the Tombigbee, Black Warrior, Alabama and Cahaba river systems.

**Habitat.** Secondary burrower in both lentic and lotic environments (Hobbs 1989).

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Orconectes alabamensis* (Faxon 1884)**

**Distribution.** North America: Tennessee River system in western Tennessee and northern Alabama. Alabama: Restricted to the Shoal Creek system in Lauderdale County, Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes australis australis* (Rhoades 1941b)**

**Distribution.** North America: Caves in southeastern Kentucky to western Tennessee and northern Alabama (Hobbs 1989). Alabama: Known only from caves in the Tennessee River system in Jackson and Madison counties (Hobbs 1989).

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

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***Orconectes chickasawae* Cooper and Hobbs 1980**

**Distribution.** North America: Hobbs (1989) reported it only from the western tributaries of the Tombigbee River in Mississippi. Alabama: There is a single record of the species in the Illinois Natural History Survey database from the Tombigbee River system; another more questionable record from the University of Alabama database is from the Cahaba River system.

**Habitat.** Lentic and slow lotic environments (Hobbs 1989).

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes compressus* (Faxon 1884); SLENDER CRAYFISH**

**Distribution.** North America: Tennessee River system in Alabama, Mississippi and western Tennessee; Cumberland River system in Kentucky and Tennessee; Barren River system in Kentucky and Tennessee. Alabama: Known only from tributaries to the Tennessee River system in northern Alabama.

**Habitat.** Streams under rocks and gravel.

**Conservation Status.** Priority 4/Low Conservation Concern

***Orconectes cooperi* Cooper and Hobbs 1980**

**Distribution.** North America: Endemic to the Flint River system in northern Alabama and western Tennessee (Hobbs 1989). Alabama: Flint River system in Madison County, Alabama.

**Habitat.** Streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes erichsonianus* (Faxon 1898)**

**Distribution.** North America: Tennessee, Elk and Coosa river systems in northern Alabama, northwestern Georgia, eastern Tennessee, and southwestern Virginia (Hobbs 1989). Alabama: Known from the Tennessee, Mobile, Black Warrior, Alabama, Cahaba, Coosa and Tallapoosa river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Orconectes forceps* (Faxon 1884)**

**Distribution.** North America: Tennessee River system from southwestern Virginia to Wayne County, Tennessee (Hobbs 1989), and northern Alabama. Alabama: Known from the tributaries of the Tennessee River; one questionable record from the University of Alabama database from the Mobile River system.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 4/Low Conservation Concern

***Orconectes holti* Cooper and Hobbs 1980**

**Distribution.** North America: Alabama River system, Alabama. Alabama: Known only from tributaries of the Alabama River in Dallas, Lowndes, Montgomery, Perry, and Wilcox counties, Alabama (Hobbs 1989).

**Habitat.** Streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes jonesi* Fitzpatrick 1992**

**Distribution.** North America: Sucarnoochee River system of Alabama and Mississippi. Alabama: Sucarnoochee River drainage in Sumter County.

**Habitat.** Streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes lancifer* (Hagen 1870), SHRIMP CRAYFISH**

**Distribution.** North America: Gulf coastal plain and Mississippi River embayment from eastern Texas to Mississippi north to Missouri, Kentucky and Illinois (Hobbs 1989); and Alabama. Alabama: Database records from the National Museum of Natural History from the Alabama River system.

**Habitat.** Slow streams and lotic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern

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***Orconectes mirus* (Ortmann 1931)**

**Distribution.** North America: Northern tributaries of the Tennessee River in western Tennessee and northern Alabama. Alabama: Tennessee River system in northern Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 4/Low Conservation Concern

***Orconectes mississippiensis* (Faxon 1884)**

**Distribution.** North America: Tributaries of the Tombigbee River in Mississippi (Hobbs 1989), and Alabama. Alabama: Database records indicate it occurs in the Tombigbee and Black Warrior river systems, with one questionable Illinois Natural History Survey record from the Tennessee River system.

**Habitat.** Streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Orconectes perfectus* Walls 1972**

**Distribution.** North America: Tombigbee and lower Alabama river systems in Alabama and Mississippi (Hobbs 1989). Alabama: Tombigbee, Black Warrior and Alabama river systems.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Orconectes placidus* (Hagen 1870); BIGCLAW CRAYFISH**

**Distribution.** North America: Lower Ohio, Cumberland, Duck and Tennessee river systems in northern Alabama, Illinois, Kentucky and Tennessee. Alabama: Known only from the Tennessee River system in northern Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 4/Low Conservation Concern

***Orconectes putnami* (Faxon 1884)**

**Distribution.** North America: Taylor (2000) defined the range as being disjunct with populations in the middle and upper Green River system and middle and upper Cumberland River system in Kentucky and Tennessee, in the western Highland Rim of the Tennessee River system of western Tennessee and northern Alabama. Alabama: Known only from the Tennessee River system in northern Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 4/Low Conservation Concern

***Orconectes sheltae* Cooper and Cooper 1997b**

**Distribution.** North America: Endemic to Shelta Cave, Alabama. Alabama: Known only from Shelta Cave, Madison County, Alabama.

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 1/Highest Conservation Concern

***Orconectes spinosus* (Bundy 1877)**

**Distribution.** North America: Taylor (2000) defined the range as being restricted to the upper Coosa River system. His distribution map included localities in Georgia and Tennessee. Alabama: According to an Illinois Natural History Survey record it also is found in the upper Coosa River system in Alabama.

**Habitat.** Streams under rocks.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Orconectes validus* (Faxon 1914)**

**Distribution.** North America: Tennessee and Black Warrior systems in northern Alabama and western Tennessee (Hobbs 1989). Alabama: Known from the Tennessee, Tombigbee, Black Warrior and Alabama river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus acutissimus* (Girard 1852)**

**Distribution.** North America: Chattahoochee River system in Georgia west to the Tombigbee River system in Mississippi (Hobbs 1989). Alabama: Known from all river systems in the state with the exception of the Mobile, Perdido, Choctawhatchee, and Chattahoochee river systems.

**Habitat.** Slow streams, pools and roadside ditches.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus acutus acutus* (Girard 1852); WHITE RIVER CRAWFISH**

**Distribution.** North America: From Maine to the Florida panhandle west to Texas, and north to Minnesota (Hobbs 1989). Alabama: Known from all river systems in the state with the exception of the Cahaba, Tallapoosa, Perdido and Chattahoochee river systems.

**Habitat.** Slow streams and lentic environments.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus bivittatus* Hobbs 1942; RIBBON CRAYFISH**

**Distribution.** North America: From the Escambia River system in Florida west to the Pearl River in Mississippi and Louisiana (Hobbs 1989). Alabama: Known from the Mobile, Tombigbee and Alabama river systems.

**Habitat.** Streams and sloughs.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus capillatus* Hobbs 1971**

**Distribution.** North America: Escambia River system in Alabama and Florida (Hobbs 1989). Alabama: Known only from the Escambia River system.

**Habitat.** Lentic environments; secondary burrower.

**Conservation Status.** Priority 2/High Conservation Concern

***Procambarus clarkii* (Girard 1852); RED SWAMP CRAWFISH**

**Distribution.** North America: Widespread from northern Mexico east to the panhandle of Florida, and north to Illinois and Ohio (Hobbs 1989). Alabama: Known from the Tennessee, Mobile, Black Warrior, Cahaba, Coosa, Tallapoosa, and Escambia river systems.

**Habitat.** Lentic and lotic environments; tertiary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus clemmeri* Hobbs 1975**

**Distribution.** North America: Pearl River system in southern Mississippi east to the Escatawpa River system in southern Alabama (Hobbs 1989). Alabama: Known from the Escatawpa River system (Pascagoula River); University of Alabama and Illinois Natural History Survey databases also include records from the Mobile and Escambia river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus escambiensis* Hobbs 1942**

**Distribution.** North America: Escambia River system in Alabama (Hobbs 1989). Alabama: Restricted to the Escambia River system, Escambia County, Alabama.

**Habitat.** Temporarily flooded woodlands and floodplains; secondary burrower.

**Conservation Status.** Priority 2/High Conservation Concern

***Procambarus evermanni* (Faxon 1890)**

**Distribution.** North America: Escambia River system in Alabama and Yellow River system in Florida west to the Pearl River system in Mississippi. Alabama: Known from Escambia County; additional database records include the Mobile and Alabama river systems.

**Habitat.** Slow streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

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***Procambarus hagenianus hagenianus* (Faxon 1884); SOUTHEASTERN PRAIRIE CRAYFISH**

**Distribution.** North America: According to Fitzpatrick (1978b) this subspecies is in the Tombigbee river system in Lowndes, Noxubee and Oktibbeha counties in Mississippi, and Marengo, Pickens and Sumter counties in Alabama. Alabama: Known only from the Tombigbee River system in Marengo, Pickens and Sumter counties.

**Habitat.** Primary burrower.

**Conservation Status.** Priority 2/High Conservation Concern

***Procambarus hayi* (Faxon 1884)**

**Distribution.** North America: Tombigbee River system in Alabama, Tallahatchie River system in Mississippi, and the Hatchie River system in Tennessee (Hobbs 1989). Alabama: Known only from the Tombigbee River system.

**Habitat.** Slow streams and lentic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus hubbelli* (Hobbs 1938)**

**Distribution.** North America: Choctawhatchee and Yellow River systems in Alabama and Florida (Hobbs 1989). Alabama: Known only from the Yellow River system.

**Habitat.** Lentic environments; secondary burrower.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus hybus* Hobbs and Walton 1957**

**Distribution.** North America: Lower Alabama and Tombigbee river systems in Alabama and Mississippi, and the Yalabusha River system in Mississippi (Hobbs 1989). Alabama: Known from the Tombigbee, Black Warrior and Alabama river systems.

**Habitat.** Lentic environments; secondary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus lagniappe* Black 1968; LAGNIAPPE CRAYFISH**

**Distribution.** North America: Tombigbee River system in Mississippi (Hobbs 1989), and in Alabama. Alabama: Known only from Sucarnoochee River system of the Tombigbee River, Sumter County, Alabama (Hartfield 1992).

**Habitat.** Streams.

**Conservation Status.** Priority 2/High Conservation Concern

***Procambarus lecontei* (Hagen 1870); MOBILE CRAYFISH**

**Distribution.** North America: Pascagoula and Mobile river systems in Alabama and Mississippi (Hobbs 1989). Alabama: Known from the Mobile, lower Tombigbee and Pascagoula river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus lewisi* Hobbs and Walton 1959**

**Distribution.** North America: Known from Barbour, Bulloch, Lowndes, Macon, Montgomery, and Russell counties Alabama (Hobbs 1989). Alabama: Collections are known from the Alabama and Choctawhatchee river systems.

**Habitat.** Slow streams and ditches.

**Conservation Status.** Priority 2/High Conservation Concern

***Procambarus lophotus* Hobbs and Walton 1960**

**Distribution.** North America: Alabama River system in Alabama and Georgia, and the Tennessee River system in Georgia and Tennessee (Hobbs 1989). Alabama: Records are known from the Tennessee, Tombigbee, Black Warrior, Alabama, Coosa, Tallapoosa, Escambia and Choctawhatchee river systems.

**Habitat.** Lentic and lotic environments; tertiary burrower.

**Conservation Status.** Priority 5/Lowest Conservation Concern

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***Procambarus marthae* Hobbs 1975**

**Distribution.** North America: Known from the Alabama River system in Alabama (Hobbs 1989). Alabama: Records are known from the Black Warrior, Cahaba and Alabama river systems.

**Habitat.** Lentic and slow moving lotic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus okaloosae* Hobbs 1942**

**Distribution.** North America: Perdido, Escambia and Yellow river systems in Alabama and Florida. Alabama: Known from the Escambia and Yellow river systems.

**Habitat.** Lentic and lotic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus paeninsulanus* (Faxon 1914)**

**Distribution.** North America: Southern Georgia, Florida (Hobbs 1989), and southeastern Alabama. Alabama: Known from the Chattahoochee River system.

**Habitat.** Lentic and lotic environment, and rarely in caves; tertiary burrower (Hobbs 1989).

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus pecki* Hobbs 1967; PHANTOM CAVE CRAYFISH**

**Distribution.** North America: Tennessee River system in northern Alabama. Alabama: Known from caves in Colbert, Lauderdale and Morgan counties.

**Habitat.** Subterranean streams.

**Conservation Status.** Priority 1/Highest Conservation Concern

***Procambarus shermani* Hobbs 1942**

**Distribution.** North America: Escambia River system in Florida west to the Pearl River system in Mississippi (Hobbs 1989). Alabama: Known from the Mobile, Tombigbee, Alabama and Pascagoula river systems.

**Habitat.** Streams and sloughs; secondary burrower.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus spiculifer* (LeConte 1856)**

**Distribution.** North America: Georgia south to Florida, and west to the Mobile and Alabama River systems in Alabama (Hobbs 1989). Alabama: Known from every river system in Alabama, with the exception of the Tennessee and Escatawpa river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus suttkusi* Hobbs 1953**

**Distribution.** North America: Choctawhatchee River system in Alabama and Florida (Hobbs 1989), and Chattahoochee River system in Alabama. Alabama: Known from the Choctawhatchee and Chattahoochee river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus verrucosus* Hobbs 1952**

**Distribution.** North America: Southeastern Alabama between the Alabama and Chattahoochee river systems (Hobbs 1989). Alabama: Known from the Alabama, Tallapoosa, Escambia and Chattahoochee river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 5/Lowest Conservation Concern

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***Procambarus versutus* (Hagen 1870)**

**Distribution.** North America: Mobile River system east to the Chattahoochee River system in Alabama, Florida and Georgia (Hobbs 1989). Alabama: Known from every river system in Alabama, with the exception of the Tennessee River system.

**Habitat.** Streams.

**Conservation Status.** Priority 5/Lowest Conservation Concern

***Procambarus viaeviridis* (Faxon 1914)**

**Distribution.** North America: Southern Illinois south to Arkansas and Louisiana, and east to Alabama (Hobbs 1989). Alabama: Reported only from the Tennessee River system in northern Alabama.

**Habitat.** Slow streams and lentic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus vioscai paynei* Fitzpatrick 1990**

**Distribution.** North America: East of the Mississippi River from the Wolfe River in Tennessee to the Tombigbee River system in Alabama, south and west to the Pascagoula, Bogue Chitto and Homochitto river systems in Mississippi (Fitzpatrick 1990). Alabama: Reported from the Tombigbee and Black Warrior river systems.

**Habitat.** Streams.

**Conservation Status.** Priority 3/Moderate Conservation Concern

***Procambarus zonangulus* Hobbs and Hobbs 1990**

**Distribution.** North America: The exact range of this species is not clearly understood. Hobbs and Hobbs (1990) in their description of this species reported it only from southeastern Texas. Taylor et al. (1996) reported it from Alabama, Louisiana, Mississippi and Texas. Alabama: It is unclear what the exact distribution of this species is in Alabama.

**Habitat.** Slow streams and lentic environments.

**Conservation Status.** Priority 3/Moderate Conservation Concern



### **C. Blackmouth Shiner Species Account**

Since *Alabama Wildlife* went to press, one new fish has been added to Alabama's fauna. The Blackmouth Shiner, a species previously known from Florida and Mississippi, was discovered in 2003. Since no species account is available in *Alabama Wildlife*, one is provided here.

## **BLACKMOUTH SHINER**

*Notropis melanostomus* Bortone

**OTHER NAMES.** Pond Creek Shiner.

**DESCRIPTION.** One of the smallest shiners in North America, reaching only 45 mm [1.8 in.] TL, with slender body, long and slender caudle peduncle, very large eye, distinct lateral stripe around snout and to base of caudal fin with a light stripe just above lateral stripe, basicaudal spot either absent or chevron-shaped, and mouth distinctly upturned (almost vertical) and bowed forward. Floor of mouth darkly pigmented. Fins falcate and pointed, anal fin long (typically 10-11 rays), caudal fin deeply forked, pored lateral-line scales typically 2-5, pharyngeal teeth 0,4-4,0 with the posterior three teeth on each arch serrated, long and numerous (15-18) gill rakers (Bortone 1989, Suttkus and Bailey 1990). Nuptial males with tubercles on dorsal surface of first six pectoral-fin rays, pelvic fins longer than females reaching beyond anal fin origin (Suttkus and Bailey 1990, O'Connell et al. 1998). Specimens from two populations (Alabama/Mississippi and Florida) show only slight morphological differences, but phylogenetic analyses of mitochondrial DNA reveal that these two populations are genetically divergent.

**DISTRIBUTION.** This species was first collected in 1939 in Pond Creek, tributary to Blackwater River, northwestern Florida, and was not collected again until 1976. A new population was discovered in adjacent Yellow River Drainage (Shoal River) in 1977 and in backwaters along the Blackwater River in 1980s. Found in Black Creek, tributary to Pascagoula River, southeastern Mississippi in 1986 (Bortone 1989, Suttkus and Bailey 1990). In the 1990s additional populations were discovered in Pascagoula River Drainage (O'Connell et al. 1998, Ross 2001). First collected in Alabama mid-April 2003 in backwater of Bay Minette Creek, Baldwin County, a tributary to lower end of Mobile-Tensaw Delta (Boschung and Mayden 2004). Specimens not collected at same site in early February 2004, but found in late March 2004. No other sites known for this species in Alabama, but no survey has been conducted for this species within the State.

**HABITAT.** Oxbow lakes and shallow backwaters (0.5-1 m [1.6-3.3 ft.]) of lowland medium-sized streams and rivers. Backwater areas typically connected to main stream in Florida, in Mississippi oxbows and floodplain pools only interconnected to stream during high water; Alabama site with connection to creek in February and April. Areas have clear, tannin-stained, acidic to moderately acidic (pH 5.4-6.8) water with no flow over soft mud and detritus or sand, and abundant submerged vegetation (pondweed, water-nymphs, and water-lilies). Occur in schools 0.2-0.5 m [0.7-1.6 ft.] below the surface in open areas adjacent to submerged vegetation, typically 1-5 m [1.6-16.4 ft.] offshore (Bortone 1989, 1993, Suttkus and Bailey 1990, O'Connell et al. 1998).

**LIFE HISTORY AND ECOLOGY.** In Florida and Mississippi, form tight irregularly-shaped schools at least 0.2 m (0.7 ft.) below the surface. These schools are almost always associated with submerged vegetation, and quite often beneath a school of Brook Silversides (*Labidesthes sicculus*) (Bortone 1993, O'Connell et al. 1998). Species is short-lived, less than two years, populations made up of few individuals over one year old. Minimum adult size 21 mm (0.8 in.) SL, adult sex ratio 1:1 (Suttkus and Bailey 1990, O'Connell et al. 1998). In Alabama, all specimens collected ( $n = 41$ ) were adults 29.7-38.2 mm (1.2-1.5

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in.) SL with 1:1 sex ratio. Spawning has not been observed, tuberculate males and gravid females collected from end of April to end of June in Florida. Males collected in Alabama in late March and mid-April with tubercles. Florida females with mature ova 0.75 mm in diameter (0.03 in.), fecundity 60-70 eggs, production of multiple clutches unknown (Bortone 1993). Ephemeral nature of isolated habitats in Mississippi may explain lower abundance (at most schools of hundreds of juveniles) relative to Florida populations (schools of thousands of individuals) and perhaps why most Mississippi sites exclusively either adults or juveniles (O'Connell et al. 1998). All Alabama specimens adults. In Florida, diet predominately plankton, mostly diatoms and desmids (phytoplankton) from August to February and cladocerans (zooplankton) from March to July (Bortone 1993).

**BASIS FOR STATUS CLASSIFICATION.** Highly vulnerable due to short life span and ephemeral nature of habitat; many sites in Mississippi dry in mid-summer (O'Connell et al. 1998, Ross 2001). In Florida encroachment of urbanization is a concern for some populations (Bortone 1989, Suttkus and Bailey 1990). Alabama specimens have been collected in backwaters with connection to Bay Minette Creek, but stability of these areas unknown during low water conditions. Water quality is a concern; the town of Bay Minette is at the headwaters of Bay Minette Creek and there are fish consumption advisories for this system.

**CONSERVATION AND MANAGEMENT RECOMMENDATION.** A comprehensive survey of backwaters and oxbows in Bay Minette Creek is needed, as well as surveys in other creek and river systems in lower Mobile Basin possessing appropriate habitat. Surveys should also be expanded into oxbows and backwaters in Escatawpa and Perdido River systems in Alabama. Multiple excursions to a system are necessary during surveys due to the ephemeral nature of these habitats and the spotty occurrence of this species. Water quality and habitat monitoring and pollution abatement should be pursued for Bay Minette Creek. In addition to monitoring water quality, current laws regulating industrial discharge should be enforced, and best management practices should be encouraged and applied with regards to timber-harvest and construction activities. Additional life history research is needed to understand basic habitat requirements and reproductive strategies in all three populations. Further studies on the relationship of the Mobile Basin population to those in Florida and Mississippi are also warranted.

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*Prepared by: Bernard R. Kuhajda*

## Appendices

## Appendix 1-3. Species of Greatest Conservation Need

Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global	State
Phylum Craniata (Vertebrata)					
Class Mammalia					
ORDER ARTIODACTYLA					
Family Bovidae					
<i>Bos bison</i>	American Bison	EX	--	G4	SX
Family Cervidae					
<i>Cervus elaphus</i>	Elk	EX	--	G5	SX
ORDER CARNIVORA					
Family Canidae					
<i>Canis rufus</i>	Red Wolf	EX	LE	G1	SX
Family Felidae					
<i>Puma concolor</i>	Mountain Lion	EX	LE	G5	SX
Family Mustelidae					
<i>Mustela frenata</i>	Long-Tailed Weasel	P2	--	G5	S3
Family Mephitidae					
<i>Spilogale putorius</i>	Eastern Spotted Skunk	P2	--	G5	S2S3
Family Ursidae					
<i>Ursus americanus</i>	Black Bear	P1	--	G5	S2
ORDER CHIROPTERA					
Family Vespertilionidae					
<i>Myotis austroriparius</i>	Southeastern Myotis	P2	--	G3G4	S2
<i>Myotis grisescens</i>	Gray Myotis	P1	LE	G3	S2
<i>Myotis lucifugus</i>	Little Brown Myotis	P2	--	G5	S3
<i>Myotis septentrionalis</i>	Northern Long-Eared Myotis	P2	--	G4	S2
<i>Myotis sodalis</i>	Indiana Myotis	P1	LE	G2	S2
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-Eared Bat	P1	--	G3G4	S2
<i>Lasiurus intermedius</i>	Northern Yellow Bat	P2	--	G4G5	S1
Family Molossidae					
<i>Tadarida brasiliensis</i>	Brazilian Free-Tailed Bat	P2	--	G5	S3
ORDER INSECTIVORA					
Family Soricidae					
<i>Sorex hoyi</i>	Pygmy Shrew	P2	--	G5	SNR
ORDER LAGOMORPHA					
Family Leporidae					
<i>Sylvilagus palustris</i>	Marsh Rabbit	P2	--	G5	S3
<i>Sylvilagus obscurus</i>	Appalachian Cottontail	P2	--	G4	S1
ORDER RODENTIA					
Family Geomyidae					
<i>Geomys pinetis</i>	Southeastern Pocket Gopher	P2	--	G5	S3
Family Muridae					
<i>Peromyscus polionotus ammobates</i>	Alabama Beach Mouse	P1	LE	G5T1	S1
<i>Peromyscus polionotus trissylepsis</i>	Perdido Key Beach Mouse	P1	LE	G5T1	S1
<i>Neotoma magister</i>	Allegheny Woodrat	P2	--	G5G4	S3
Family Dipodidae					
<i>Zapus hudsonius</i>	Meadow Jumping Mouse	P2	--	G5	S3
ORDER SIRENIA					
Family Trichechidae					

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Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global	State
<i>Trichechus manatus</i>	West Indian Manatee	P1	LE	G2	SA
<b>Class Aves</b>					
<b>ORDER ANSERIFORMES</b>					
Family Anatidae					
<i>Anas rubripes</i>	American Black Duck	P2	--	G5	S2B
Order Charadriiformes					
Family Charadriidae					
<i>Charadrius alexandrinus</i>	Snowy Plover	P1	--	G3	S1B
<i>Charadrius wilsonia</i>	Wilson's Plover	P1	--	G5	S1
<i>Charadrius melodus</i>	Piping Plover	P1	LT	G3	S1N
Family Haematopodidae					
<i>Haematopus palliatus</i>	American Oystercatcher	P2	--	G5	S1
Family Scolopacidae					
<i>Scolopax minor</i>	American Woodcock	P2	--	G5	S4B
<b>ORDER CICONIIFORMES</b>					
Family Ardeidae					
<i>Ixobrychus exilis</i>	Least Bittern	P2	--	G5	S4B
<i>Egretta rufescens</i>	Reddish Egret	P2	--	G4	S1B
Family Ciconiidae					
<i>Mycteria americana</i>	Wood Stork	P2	LE	G4	S2N
<b>ORDER FALCONIFORMES</b>					
Family Accipitridae					
<i>Elanoides forficatus</i>	Swallow-Tailed Kite	P2	--	G5	S2
<i>Circus cyaneus</i>	Northern Harrier	P2	--	G5	S2B
Family Falconidae					
<i>Falco sparverius</i>	American Kestrel	P2	--	G5	SNR
<b>ORDER GRUIFORMES</b>					
Family Rallidae					
<i>Coturnicops noveboracensis</i>	Yellow Rail	P2	--	G4	S2N
<i>Laterallus jamaicensis</i>	Black Rail	P2	--	G4	S2N
<b>ORDER PASSERIFORMES</b>					
Family Corvidae					
<i>Corvus corax</i>	Common Raven	EX	--	G5	SX
Family Emberizidae					
<i>Aimophila aestivalis</i>	Bachman's Sparrow	P2	--	G3	S3
<i>Ammodramus henslowii</i>	Henslow's Sparrow	P1	--	G4	S2N
<i>Ammodramus nelsoni</i>	Nelson's Sharp-Tailed Sparrow	P2	--	G5	S3N
<i>Ammodramus maritimus</i>	Seaside Sparrow	P2	--	G4	SNR
Family Parulidae					
<i>Dendroica cerulea</i>	Cerulean Warbler	P1	--	G4	S2B
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler	P2	--	G4	S3B
<i>Limnethlypis swainsonii</i>	Swainson's Warbler	P2	--	G4	S3B
<i>Oporornis formosus</i>	Kentucky Warbler	P2	--	G5	S5B
Family Turdidae					
<i>Hylocichla mustelina</i>	Wood Thrush	P2	--	G5	S5B
Family Troglodytidae					
<i>Thryomanes bewickii</i>	Bewick's Wren	P1	-	G5	S1
<b>ORDER PICIFORMES</b>					
Family Picidae					
<i>Campephilus principalis</i>	Ivory-Billed Woodpecker	EX	LE	GH	SX
<i>Picoides borealis</i>	Red-Cockaded Woodpecker	P1	LE	G3	S2
<b>ORDER STRIGIFORMES</b>					
Family Strigidae					
<i>Asio flammeus</i>	Short-Eared Owl	P2	--	G5	SNA

## Appendices

Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global	State
<b>Class Reptilia</b>					
<b>ORDER LACERTILIA</b>					
Family Anguidae					
<i>Ophisaurus mimicus</i>	Mimic Glass Lizard	P2	--	G3	S2
Family Scincidae					
<i>Eumeces anthracinus</i> ssp.	Coal Skink	P2	--	G5	S3
<i>Eumeces inexpectatus</i>	Southeastern Five-Lined Skink	P2	--	G5	S5
<b>ORDER SERPENTES</b>					
Family Colubridae					
<i>Drymarchon couperi</i>	Eastern Indigo Snake	P1	LT	G3	S1
<i>Farancia erythrogramma</i>	Rainbow Snake	P2	--	G5	S3
<i>Heterodon simus</i>	Southern Hognose Snake	P1	--	G2	SH
<i>Lampropeltis calligaster calligaster</i>	Prairie Kingsnake	P2	--	G5	S1S2
<i>Lampropeltis getula getula</i>	Eastern Kingsnake	P2	--	G5	S5
<i>Lampropeltis getula holbrooki</i>	Speckled Kingsnake	P2	--	G5	S5
<i>Pituophis melanoleucus lodingi</i>	Black Pine Snake	P1	C	G4T3	S2
<i>Pituophis melanoleucus melanoleucus</i>	Northern Pine Snake	P2	--	G4T4	S3
<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake	P2	--	G4T3?	S2
<i>Seminatrix pygaea pygaea</i>	North Florida Swamp Snake	P2	--	G5	T2
Family Elapidae					
<i>Micrurus fulvius</i>	Eastern Coral Snake	P2	--	G5	S3
Family Viperidae					
<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	P2	--	G4	S3
<b>ORDER TESTUDINES</b>					
Family Cheloniidae					
<i>Caretta caretta</i>	Loggerhead Sea Turtle	P1	LT	G3	S1
<i>Chelonia mydas</i>	Green Sea Turtle	P1	LT	G3	S1
<i>Lepidochelys kempii</i>	Kemp's Ridley Sea Turtle	P1	LE	G1	SZN
Family Chelydridae					
<i>Macrochelys temminckii</i>	Alligator Snapping Turtle	P2	--	G3G4	S3
Family Dermochelyidae					
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	P1	LE	G3	SZN
Family Emydidae					
<i>Graptemys barbouri</i>	Barbour's Map Turtle	P2	--	G2	S2
<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin	P1	--	G4T3	S1S2
<i>Pseudemys alabamensis</i>	Alabama Red-Bellied Turtle	P1	LE	G1	S1
Family Kinosternidae					
<i>Sternotherus carinatus</i>	Razor-Backed Musk Turtle	P2	--	G5	S1
<i>Sternotherus depressus</i>	Flattened Musk Turtle	P2	LT	G2	S2
Family Testudinidae					
<i>Gopherus polyphemus</i>	Gopher Tortoise	P2	LT	G3	S2
<b>Class Amphibia</b>					
<b>ORDER ANURA</b>					
Family Hylidae					
<i>Hyla andersonii</i>	Pine Barrens Treefrog	P2	--	G4	S2
<i>Pseudacris ocularis</i>	Little Grass Frog	P2	--	G5	S1

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Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global	State
Family Ranidae					
<i>Rana capito</i>	Gopher Frog	P1	--	G3	S2
<i>Rana sevosa</i>	Mississippi Gopher Frog	P1	LE	G1	SH
<i>Rana heckscheri</i>	River Frog	P1	--	G5	S1
ORDER CAUDATA					
Family Ambystomatidae					
<i>Ambystoma cingulatum</i>	Flatwoods Salamander	P1	LT	G2G3	S1
Family Amphiumidae					
<i>Amphiuma pholeter</i>	One-Toed Amphiuma	P2	--	G3	S1
Family Cryptobranchidae					
<i>Cryptobranchus alleganiensis</i>	Eastern Hellbender	P1	--	G4	S2
Family Plethodontidae					
<i>Aneides aeneus</i>	Green Salamander	P2	--	G3G4	S3
<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	P1	--	G5	SU
<i>Desmognathus aeneus</i>	Seepage Salamander	P2	--	G3G4	S2
<i>Gyrinophilus pallescens</i>	Tennessee Cave Salamander	P2	--	G2G3	S2
<i>Phaeognathus hubrichti</i>	Red Hills Salamander	P2	LT	G2	S2
Family Proteidae					
<i>Necturus alabamensis</i>	Black Warrior Waterdog	P2	C	G2	S2
<b>Class Actinopterygii</b>					
ORDER ACIPENSERIFORMES					
Family Acipenseridae					
<i>Acipenser fulvescens</i>	Lake Sturgeon	EXCAU*	--	G3	SX
<i>Acipenser oxyrinchus desotoi</i>	Gulf Sturgeon	P2	LT	G3T2	S1
<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon	EX	--	G4	SX
<i>Scaphirhynchus suttkusi</i>	Alabama Sturgeon	P1	LE	G1	S1
ORDER Lepisosteiformes					
Family Lepisosteidae					
<i>Lepisosteus platostomus</i>	Shortnose Gar	EX	--	G5	SH
ORDER HIODONTIFORMES					
Family Hiodontidae					
<i>Hiodon alosoides</i>	Goldeye	EX	--	G5	SX
ORDER CLUPEIFORMES					
Family Clupeidae					
<i>Alosa alabamae</i>	Alabama Shad	P2	--	G3	S2
ORDER CYPRINIFORMES					
Family Cyprinidae					
<i>Cyprinella caerulea</i>	Blue Shiner	P2	LT	G2	S1
<i>Erimonax monachus</i>	Spotfin Chub	EX	LT	G2	SX
<i>Erimystax dissimilis</i>	Streamline Chub	P2	--	G4	S1
<i>Macrhybopsis aestivalis hyostoma</i>	Shoal Chub	P2	--	G5	S3
<i>Notropis ariommus</i>	Popeye Shiner	EX	--	G3	SX
<i>Notropis albizonatus</i>	Palezone Shiner	P1	LE	G2	S1
<i>Notropis buechanani</i>	Ghost Shiner	P2	--	G5	S2
<i>Notropis cahabae</i>	Cahaba Shiner	P1	LE	G2	S2
<i>Notropis chalybaeus</i>	Ironcolor Shiner	P1	--	G4	S1
<i>Notropis cummingsae</i>	Dusky Shiner	P2	--	G5	S2
<i>Notropis melanostomus</i>	Blackmouth Shiner	P2*	--	G2	SNR
<i>Phenacobius mirabilis</i>	Suckermouth Minnow	P2	--	G5	S1
<i>Phenacobius uranops</i>	Stargazing Minnow	P2	--	G4	S1
<i>Pteronotropsis euryzonus</i>	Broadstripe Shiner	P2	--	G3	S2
<i>Pteronotropsis welaka</i>	Bluenose Shiner	P2	--	G3G4	S2
ORDER SILURIFORMES					

## Appendices

Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global	State
Family Ictaluridae					
<i>Noturus elegans</i>	Elegant Madtom	EX	--	G4	SH
<i>Noturus eleutherus</i>	Mountain Madtom	P2	--	G4	S1
<i>Noturus miurus</i>	Brindled Madtom	P2	--	G5	S1
<i>Noturus munitus</i>	Frecklebelly Madtom	P2	--	G3	S2
<i>Noturus</i> sp. cf. <i>flavus</i>	Highlands Stonecat	P2	--	G5	S1
ORDER AMBLYOPSIFORMES					
Family Amblyopsidae					
<i>Speoplatyrhinus poulsoni</i>	Alabama Cavefish	P1	LE	G1	S1
ORDER SCORPAENIFORMES					
Family Cottidae					
<i>Cottus paulus</i>	Pygmy Sculpin	P1	LT	G1	S1
ORDER PERCIFORMES					
Family Elasmobranchidae					
<i>Elassoma alabamiae</i>	Spring Pygmy Sunfish	P1	--	G1	S1
Family Centrarchidae					
<i>Micropterus cataractae</i>	Shoal Bass	P2	--	G3	S2
Family Percidae					
<i>Etheostoma boschungii</i>	Slackwater Darter	P1	LT	G1	S2
<i>Etheostoma brevirostrum</i>	Holiday Darter	P1	--	G2	S1
<i>Etheostoma camurum</i>	Bluebreast Darter	P2	--	G4	S1
<i>Etheostoma chermocki</i>	Vermilion Darter	P1	LE	G1	S1
<i>Etheostoma chuckwachatte</i>	Lipstick Darter	P2	--	G2G3	S2
<i>Etheostoma cinereum</i>	Ashy Darter	EX	--	G2G3	SX
<i>Etheostoma ditrema</i>	Coldwater Darter	P2	--	G1G2	S1
<i>Etheostoma lynceum</i>	Brighteye Darter	P1	--	G5	S1
<i>Etheostoma neopterum</i>	Lollipop Darter	P1	--	G3	S1
<i>Etheostoma nuchale</i>	Watercress Darter	P1	LE	G1	S1
<i>Etheostoma</i> sp. cf. <i>bellator</i>	Locust Fork Darter	P2	--	--	--
<i>Etheostoma</i> sp. cf. <i>bellator</i>	Sipsey Darter	P2	--	--	--
<i>Etheostoma</i> sp. cf. <i>zonistium</i>	Blueface Darter	P2	--	--	--
<i>Etheostoma trisella</i>	Trispot Darter	EX	--	G1	SX
<i>Etheostoma tuscumbia</i>	Tuscumbia Darter	P2	--	G2	S2
<i>Etheostoma wapiti</i>	Boulder Darter	P1	LE	G1	S1
<i>Etheostoma zonistium</i>	Bandfin Darter	P2	--	G4G5	S1
<i>Etheostoma phytophilum</i>	Rush Darter	P1	C	G1	S1
<i>Percina aurolineata</i>	Goldline Darter	P1	LT	G2	S1
<i>Percina brevicauda</i>	Coal Darter	P2	--	G2	S2
<i>Percina burtoni</i>	Blotchside Logperch	P1*	--	G2	S1
<i>Percina evides</i>	Gilt Darter	P2	--	G4	S2
<i>Percina phoxocephala</i>	Slenderhead Darter	P1	--	G5	S1
<i>Percina</i> sp.	Halloween Darter	P1	--	--	--
<i>Percina</i> sp. cf. <i>macrocephala</i>	Warrior Bridled Darter	P1	--	G1	S1
<i>Percina tanasi</i>	Snail Darter	P1	LT	G2G3	S1
Phylum Mollusca					
Class Bivalvia					
ORDER UNIONOIDA					
Family Margaritiferidae					
<i>Cumberlandia monodonta</i>	Spectaclecase	P1	--	G2G3	S1
<i>Margaritifera marrianae</i>	Alabama Pearlshell	P1	C	G1	S1S2
Family Unionidae					
<i>Actinonaias ligamentina</i>	Mucket	P1	--	G5	S2
<i>Actinonaias pectorosa</i>	Pheasantshell	EX	--	G4	SH



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<i>Alasmidonta marginata</i>	Elktoe	EX	--	G4	SH
<i>Alasmidonta triangulata</i>	Southern Elktoe	P1*	--	G2Q	S1
<i>Alasmidonta viridis</i>	Slippershell Mussel	P1	--	G4G5	S1
<i>Anodontoides radiatus</i>	Rayed Creekshell	P2	--	G3	S1S2
<i>Cyprogenia stegaria</i>	Fanshell	P1	LE	G1	S1
<i>Dromus dromas</i>	Dromedary Pearlymussel	EXCAU	LE-XP	G1	S1
<i>Elliptio arca</i>	Alabama Spike	P1	--	G3	S2
<i>Elliptio arctata</i>	Delicate Spike	P1	--	G4Q	S2
<i>Elliptio chipolaensis</i>	Chipola Slabshell	EX	LT	G2Q	S1
<i>Elliptio dilatata</i>	Spike	P1	--	G5	S1
<i>Elliptio fraterna</i>	Brother Spike	EX	--	G1G2Q	S1
<i>Elliptio mcMichaeli</i>	Fluted Elephantear	P1	--	G3	S2
<i>Elliptio purpurella</i>	Inflated Spike	P1	--	G3	S1
<i>Epioblasma brevidens</i>	Cumberland Combshell	P1	LE	G1	S1
<i>Epioblasma capsaeformis</i>	Oyster Mussel	EXCAU	LE-XP	G1	S1
<i>Epioblasma florentina</i>	Yellow Blossom	EX*	LE	G1	S1?
<i>Epioblasma metastrata</i>	Upland Combshell	EX	LE	GH	SH
<i>Epioblasma obliquata obliquata</i>	Catspaw	EX	LE-XP	G1T1	SX
<i>Epioblasma othcaloogensis</i>	Southern Acornshell	EX	LE	GHQ	SH
<i>Epioblasma penita</i>	Southern Combshell	P1	LE	GHQ	SH
<i>Epioblasma triquetra</i>	Snuffbox	P1	--	G3	S1
<i>Fusconaia burkei</i>	Tapered Pigtoe	P2	--	G2	S1
<i>Fusconaia cor</i>	Shiny Pigtoe	P1	LE	G1	S1
<i>Fusconaia cuneolus</i>	Finerayed Pigtoe	P1	LE	G1	S1
<i>Fusconaia escambia</i>	Narrow Pigtoe	P1	--	G2	S2
<i>Fusconaia rotulata</i>	Round Ebonyshell	P1	--	G1	S1
<i>Fusconaia subrotunda</i>	Longsolid	P1	--	G3	S1
<i>Hamiota altilis</i>	Finelined Pocketbook	P2	LT	G2	G2
<i>Hamiota australis</i>	Southern Sandshell	P1	--	G2	S1S2
<i>Hamiota perovalis</i>	Orangenacre Mucket	P2	LT	G2	S1
<i>Hamiota subangulata</i>	Shinyrayed Pocketbook	P1	LE	G2	S1
<i>Hemistena lata</i>	Cracking Pearlymussel	P1	LE	G1	SX
<i>Lampsilis abrupta</i>	Pink Mucket	P1	LE	G2	S1
<i>Lampsilis virescens</i>	Alabama Lampmussel	P1	LE	G1	S1
<i>Lasmigona costata</i>	Flutedshell	P2	--	G5	S2
<i>Lasmigona holstonia</i>	Tennessee Heelsplitter	P2	--	G3	S1S2
<i>Lasmigona subviridis</i>	Green Floater	EX	--	G3	SX
<i>Lemiox rimosus</i>	Birdwing Pearlymussel	EXCAU	LE	G1	SX
<i>Leptodea leptodon</i>	Scaleshell	EX	LE	G1	SX
<i>Ligumia recta</i>	Black Sandshell	P2	--	G5	S2
<i>Medionidus acutissimus</i>	Alabama Moccasinshell	P2	LT	G1	S1
<i>Medionidus conradicus</i>	Cumberland Moccasinshell	P1	--	G3G4	S1
<i>Medionidus parvulus</i>	Coosa Moccasinshell	EX	LE	G1	S1S2
<i>Medionidus penicillatus</i>	Gulf Moccasinshell	P1	LE	G2	S1S2
<i>Obovaria olivaria</i>	Hickorynut	EX	--	G4	SH
<i>Obovaria retusa</i>	Ring Pink	P1	LE	G1	S1
<i>Obovaria subrotunda</i>	Round Hickorynut	P1	--	G4	S2
<i>Obovaria unicolor</i>	Alabama Hickorynut	P2	--	G3	S2
<i>Pegias fabula</i>	Little-Wing Pearlymussel	EX	LE	G1	SX
<i>Plectomerus sloatianus</i>	Purple Bankclimber	P1	LT	G2	S1
<i>Plethobasus cicatricosus</i>	White Wartyback	P1	LE	G1	S1
<i>Plethobasus cooperianus</i>	Orangefoot Pimpleback	P1	LE	G1	S1

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<i>Plethobasus cyphus</i>	Sheepnose	P1	--	G3	S1
<i>Pleurobema clava</i>	Clubshell	EX	LE-XP	G2	SX
<i>Pleurobema curtum</i>	Black Clubshell	EX	LE	G1	S1
<i>Pleurobema decisum</i>	Southern Clubshell	P2	LE	G1G2	S1S2
<i>Pleurobema georgianum</i>	Southern Pigtoe	P1	LE	G1	S1
<i>Pleurobema hanleyianum</i>	Georgia Pigtoe	EX*	--		
<i>Pleurobema marshalli</i>	Flat Pigtoe	EX	LE	GH	SH
<i>Pleurobema oviforme</i>	Tennessee Clubshell	P1	--	G3	S1
<i>Pleurobema perovatum</i>	Ovate Clubshell	P1	LE	G1	S1
<i>Pleurobema plenum</i>	Rough Pigtoe	P1	LE	G1	S1
<i>Pleurobema pyriforme</i>	Oval Pigtoe	P1	LE	G1	S1
<i>Pleurobema rubellum</i>	Warrior Pigtoe	P1*	--		
<i>Pleurobema rubrum</i>	Pyramid Pigtoe	P1	--	G2	S2
<i>Pleurobema sintoxia</i>	Round Pigtoe	P1	--	G4	S1
<i>Pleurobema strodeanum</i>	Fuzzy Pigtoe	P2	C	G2	S1S2
<i>Pleurobema taitianum</i>	Heavy Pigtoe	P1	LE	G1	S1
<i>Pleuonaia barnesiana</i>	Tennessee Pigtoe	P2	--	G2G3	S1
<i>Pleuonaia dolabelloides</i>	Slabside Pearlymussel	P1	C	G2	S1
<i>Potamilus inflatus</i>	Alabama Heelsplitter	P2	LT	G1	S1
<i>Ptychobranhus fasciolaris</i>	Kidneyshell	P1	--	G4G5	S1
<i>Ptychobranhus foremanianus</i>	Rayed Kidneyshell	P1*	--		
<i>Ptychobranhus greenii</i>	Triangular Kidneyshell	P1	LE	G1	S1
<i>Ptychobranhus jonesi</i>	Southern Kidneyshell	P1	C	G1	S1
<i>Ptychobranhus subtentum</i>	Fluted Kidneyshell	EX	C	G4	SX
<i>Quadrula infucata</i>	Sculptured Pigtoe	P1	--	G4	S2
<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot	P1	--	G3T3	S1
<i>Quadrula intermedia</i>	Cumberland Monkeyface	EX	LE	G1	SH
<i>Strophitus connasaugaensis</i>	Alabama Creekmussel	P2	--	G3	S2
<i>Strophitus undulatus</i>	Creeper	P1	--	G5	S1
<i>Toxolasma corvunculus</i>	Southern Purple Lilliput	P1	--	GH	S1
<i>Toxolasma cylindrellus</i>	Pale Lilliput	P1	LE	G1	S1
<i>Truncilla truncata</i>	Deertoe	P1	--	G5	S1
<i>Villosa choctawensis</i>	Choctaw Bean	P2	C	G2	S2
<i>Villosa fabalis</i>	Rayed Bean	EX*	C	G1G2	SX
<i>Villosa trabalis</i>	Cumberland Bean	EX	LE-XP	G1	SX
<i>Villosa umbrans</i>	Coosa Creekshell	P2	--	G4T2	S2
<i>Villosa villosa</i>	Downy Rainbow	P2	--	G3	SNR

## Class Gastropoda

## ORDER ARCHITAENIOGLOSSA

## Family Viviparidae

<i>Campeloma decampi</i>	Slender Campeloma	P1	LE	G1	S1
<i>Lioplax cyclostomaformis</i>	Cylindrical Lioplax	P1	LE	G1	S1
<i>Tulotoma magnifica</i>	Tulotoma	P1	LE	G1	S1

## ORDER NEOTAENIOGLOSSA

## Family Hydrobiidae

<i>Clappia cahabensis</i>	Cahaba Pebblesnail	P1	--	G1	S1
<i>Lepyrium showalteri</i>	Flat Pebblesnail	P1	LE	G1	S1
<i>Marstonia pachyta</i>	Armored Marstonia	P1	LE	G1	S1
<i>Marstonia scalariformis</i>	Moss Pyrg	P1	--	G1	S1

## Family Pleuroceridae

<i>Athearnia anthonyi</i>	Anthony's Riversnail	P1	LE	G1	S1
<i>Elimia ampla</i>	Ample Elimia	P2	--	G1	S1

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<i>Elimia annettae</i>	Lilyshoals Elimia	P2	--	G1Q	S1
<i>Elimia bellacrenata</i>	Princess Elimia	P1	--	G1	S1
<i>Elimia cochliaris</i>	Cockle Elimia	P1	--	G1	S1
<i>Elimia crenatella</i>	Lacy Elimia	P1	LT	G1	S1
<i>Elimia lachryma</i>	Teardrop Elimia	P1*	--	GH	SX
<i>Elimia melanoides</i>	Black Mudalia	P2	--	G2	S1
<i>Elimia nassula</i>	Round-Rib Elimia	P1	--	G1	S1
<i>Elimia perstriata</i>	Engraved Elimia	P1	--	G1	S1
<i>Elimia vanuxemiana</i>	Cobble Elimia	P1*	--	GH	SH
<i>Elimia varians</i>	Puzzle Elimia	P2	--	G1Q	SH
<i>Elimia variata</i>	Squat Elimia	P2	--	G1Q	S1
<i>Io fluvialis</i>	Spiny Riversnail	EXCAU	--	G2	SX
<i>Leptoxis ampla</i>	Round Rocksnail	P2	LT	G1G2	S1
<i>Leptoxis foremani</i>	Interrupted Rocksnail	EXCAU	C	G1	SNR
<i>Leptoxis picta</i>	Spotted Rocksnail	P2	--	G1	SH
<i>Leptoxis plicata</i>	Plicate Rocksnail	P1	LE	G1	S1
<i>Leptoxis taeniata</i>	Painted Rocksnail	P2	LT	G1	S1
<i>Leptoxis virgata</i>	Smooth Mudalia	EX	--	G2	SX
<i>Lithasia armigera</i>	Armored Rocksnail	P2	--	G3G4	S1
<i>Lithasia curta</i>	Knobby Rocksnail	EX	--	G1	S1
<i>Lithasia lima</i>	Warty Rocksnail	P2	--	G2	S1
<i>Lithasia salebrosa</i>	Muddy Rocksnail	P2	--	G3G4	S1
<i>Pleurocera alveare</i>	Rugged Hornsnail	P2	--	G3G4	SNR
<i>Pleurocera corpulenta</i>	Corpulent Hornsnail	P1	--	G1	S1
<i>Pleurocera foremani</i>	Rough Hornsnail	P1	--	G1Q	S1
<i>Pleurocera pyrenella</i>	Skirted Hornsnail	P2	--	G2	S2

## Phylum Arthropoda

## Class Crustacea

## ORDER DECAPODA

## Family Cambaridae

<i>Cambarellus diminutus</i>	Least Crayfish	P2	--	G3	S3
<i>Cambarellus lesliei</i>	unnamed crayfish	P2	--	G3	S3
<i>Cambarus cracens</i>	unnamed crayfish	P2	--	G1	S1
<i>Cambarus englishi</i>	unnamed crayfish	P2	--	G3	S3
<i>Cambarus halli</i>	unnamed crayfish	P2	--	G3G4	S3
<i>Cambarus hamulatus</i>	unnamed crayfish	P2	--	G3G4	S2
<i>Cambarus howardi</i>	unnamed crayfish	P2	--	G3	S3
<i>Cambarus jonesi</i>	Alabama Cave Crayfish	P2	--	G2	S2
<i>Cambarus millus</i>	Rusty Grave Digger	P2	--	G1	S1
<i>Cambarus scotti</i>	unnamed crayfish	P2	--	G3	SR
<i>Cambarus unestami</i>	unnamed crayfish	P2	--	G1	S2
<i>Cambarus veitchorum</i>	White Spring Cave Crayfish	P1	--	G1	S1
<i>Fallicambarus burrisi</i>	unnamed crayfish	P2	--	G1G2	S1
<i>Fallicambarus danielae</i>	unnamed crayfish	P2	--	G1	S1
<i>Fallicambarus oryktos</i>	unnamed crayfish	P2	--	G4	SNR
<i>Orconectes alabamensis</i>	unnamed crayfish	P2	--	G5	SNR

## Appendices

Scientific Name	English Name	Priority Rank	Federal Rank	NatureServe Global State	
<i>Orconectes chickasawae</i>	unnamed crayfish	P2	--	G5	SNR
<i>Orconectes cooperi</i>	unnamed crayfish	P2	--	G1	S1
<i>Orconectes holti</i>	unnamed crayfish	P2	--	G3	S3
<i>Orconectes jonesi</i>	unnamed crayfish	P2	--	G1G1	SNR
<i>Orconectes mississippiensis</i>	unnamed crayfish	P2	--	G1G3	S2S3
<i>Orconectes sheltae</i>	unnamed crayfish	P1	--	G1	S1
<i>Procambarus capillatus</i>	unnamed crayfish	P2	--	G4	S3
<i>Procambarus escambiensis</i>	unnamed crayfish	P2	--	G1	S2
<i>Procambarus h. hagenianus</i>	Southeastern Prairie Crayfish	P2	--	G4G5	SNR
<i>Procambarus lagniappe</i>	Lagniappe Crayfish	P2	--	G1	S1
<i>Procambarus lewisi</i>	unnamed crayfish	P2	--	G4	S3
<i>Procambarus pecki</i>	Phantom Cave Crayfish	P1	--	G1G3	S1

- revised since 2002 Nongame Conference

## Appendices

## Appendix 1-4. Other Imperiled Invertebrates

For certain invertebrate species with limited distribution or dependence upon threatened habitats, NatureServe has assigned conservation status. Alabama has 30 terrestrial snails, five spiders, one harvestman, 40 pseudoscorpions, four millipedes, 38 beetles, five springtails, two diplurans, four mayflies, three butterflies and moths, four dragonflies and damselflies, one stonefly, three amphipods, three cave shrimp, and one isopod that are ranked by NatureServe (2004) as globally critically imperiled (G1) or imperiled (G2), but for purposes of this CWCS, taxa from these groups are not treated as GCN species. This CWCS acknowledges their presence, the need for additional information, as well as the possible need to include them as GCN species in the future.

Scientific Name	English Name	Federal Rank	NatureServe	
			Global	State
Class Gastropoda				
ORDER ARCHITAENIOGLOSSA				
Family Viviparidae				
<i>Campeloma regulare</i>	Cylinder Campeloma	--	G1G2	SNR
ORDER BASOMMATOPHORA				
Family Ancyliidae				
<i>Ferrissia mcneilli</i>	Hood Ancylid	--	G1G3	S2
<i>Rhodacme elatior</i>	Domed Ancylid	--	G1	S1
<i>Rhodacme hinkleyi</i>	Knobby Ancylid	--	G1G3	S2
ORDER NEOTAENIOGLOSSA				
Family Hydrobiidae				
<i>Pseudotryonia grahamae</i>	Salt Spring Hydrobe	--	G1	SNR
<i>Pyrgulopsis hershleri</i>	Coosa Pyrg	--	G1	SU
<i>Somatogyrus hinckleyi</i>	Granite Pebblesnail	--	G1	SNR
<i>Somatogyrus pilsbryanus</i>	Tallapoosa Pebblesnail	--	G1	SNR
<i>Somatogyrus pumilus</i>	Compact Pebblesnail	--	G1G2	SU
<i>Stiobia nana</i>	Sculpin Snail	--	G1	S1
Family Pleuroceridae				
<i>Elimia acuta</i>	Acute Elimia	--	G1	S1

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<i>Elimia alabamensis</i>	Mud Elimia	--	G1	S1
<i>Elimia bentoniensis</i>	Rusty Elimia	--	G1	S1
<i>Elimia bullula</i>	an unnamed Elimia	--	G1G2	S1S2
<i>Elimia chiltonensis</i>	Prune Elimia	--	G1	S1
<i>Elimia clenchi</i>	Slackwater Elimia	--	G1G2	S1S2
<i>Elimia comma</i>	Hispid Elimia	--	G1	SNR
<i>Elimia cylindracea</i>	Cylinder Elimia	--	G1	S1
<i>Elimia haysiana</i>	Silt Elimia	--	G1	S1
<i>Elimia hydei</i>	Gladiator Elimia	--	G2	S1
<i>Elimia interveniens</i>	Slowwater Elimia	--	G2	S2
<i>Elimia pybasi</i>	Spring Elimia	--	G2	SNR
<i>Lithasia curta</i>	Knobby Rocksnail	--	G1	S1
<i>Pleurocera annulifera</i>	Ringed Hornsnail	--	G1	S1
<i>Pleurocera trochiformis</i>	Sulcate Hornsnail	--	G2	SNR
<i>Pleurocera walkeri</i>	Telescope Hornsnail	--	G1	S1
ORDER STYLOMMATOPHORA				
Family Discidae				
<i>Anguispira alabama</i>	Alabama Tigersnail	--	G1	S2?
<i>Anguispira cumberlandiana</i>	Cumberland Tigersnail	--	G1G2	S1S2
<i>Discus clappi</i>	Channelled Disc	--	G1	S1
Family Helicarionidae				
<i>Dryachloa dauca</i>	Carrot Glass	--	G1G2	S1
Family Helicodiscidae				
<i>Helicodiscus aldrichianus</i>	Burrowing Coil	--	G1	SNR
<i>Helicodiscus hadenoecus</i>	Cricket Coil	--	G1	SNR
Family Philomycidae				
<i>Philomycus sellatus</i>	Alabama Mantleslug	--	G1G3	S1?
Family Polygyridae				

## Appendices

<i>Inflectarius approximans</i>	Tight-Gapped Shagreen	--	G1	S2?
<i>Millerelix fatigiata</i>	New Harmony Liptooth	--	G1	S1?
<i>Patera sargentiana</i>	Grand Bladetooth	--	G1	S1
<i>Stenotrema brevipila</i>	Talladega Slitmouth	--	G1	SNR
<i>Stenotrema calvescens</i>	Chattanooga Slitmouth	--	G1	SNR
<i>Stenotrema exodon</i>	Alabama Slitmouth	--	G1	SNR
Family Pupillidae				
<i>Vertigo alabamensis</i>	Alabama Vertigo	--	G1G2	S1S2
<i>Vertigo conecuhensis</i>	Conecuh Vertigo	--	G1	S1
Family Succineidae				
<i>Catinella aprica</i>	Diurnal Ambersnail	--	G1	S2?
<i>Catinella pugillator</i>	Weedpatch Ambersnail	--	G1G2	S1
<i>Succinea paralia</i>	Saltmarsh Ambersnail	--	G1	SNR
<i>Succinea urbana</i>	Urban Ambersnail	--	G1G3	SNR
Family Zonitidae				
<i>Glyphyalinia cumberlandiana</i>	Hill Glyph	--	G4	SNR
<i>Glyphyalinia latebricola</i>	Stone Glyph	--	G1G2	SNR
<i>Glyphyalinia pecki</i>	Blind Glyph	--	G1G2	SNR
<i>Paravitrea bidens</i>	Gray Supercoil	--	G1	S1
<i>Paravitrea petrophila</i>	Cherokee Supercoil	--	G2G3	S1
<i>Paravitrea pilsbryana</i>	Translucent Supercoil	--	G1	S2?
<i>Paravitrea tantilla</i>	Teasing Supercoil	--	G2G3	S1?
<i>Paravitrea tiara</i>	Crowned Supercoil	--	G1G2	S1?
<i>Paravitrea toma sharp</i>	Supercoil	--	G1	S1?
<i>Paravitrea umbilicaris</i>	Open Supercoil	--	G1	SNR
<i>Paravitrea variabilis</i>	Variable Supercoil	--	G1	S1?
<i>Ventridens monodon</i>	Blade Dome	--	G1	SNR
<i>Zonitoides lateumbilicatus</i>	Striate Gloss	--	G1G2	SNR



## Appendices

## PHYLUM CHELICERATA

## Class Arachnida

## ORDER ARANEAE

## Family Dictynidae

<i>Cicurina wiltoni</i>	a cave obligate spider	--	G1	S1
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## Family Leptonetidae

<i>Neoleptoneta serena</i>	a cave obligate spider	--	G1G2	S1S2
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## Family Linyphiidae

<i>Islandiana muma</i>	a cave spider	--	G1G2	SNR
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<i>Islandiana</i> sp. P1	a spider		G1	SNR
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## Family Nesticidae

<i>Nesticus jonesi</i>	Cave Spring Cave Spider	--	G1	S1
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## ORDER OPILONES

## Family Phalangodidae

<i>Bishopella jonesi</i>	a cave obligate harvestman	--	G1	S1S2
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*Psuedoscorpions*

## ORDER PSEUDOSCORPIONES

## Family Chthoniidae

<i>Aphrastochthonius pecki</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Aphrastochthonius tenax</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
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<i>Apochthonius russelli</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius aladdinensis</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius aralu</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius archeri</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius attenuatus</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius avernicolus</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius barri</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius binocularis</i>	a cave obligate pseudoscorpion	--	G1	S1
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<i>Tyrannochthonius chamberlini</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius charon</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius diabolus</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
<i>Tyrannochthonius erebicus</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius felix</i>	a cave obligate pseudoscorpion	--		G1
<i>Tyrannochthonius gnomus</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius halopotamus</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius infernalis</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius jonesi</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius nergal</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius orpheus</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius osiris</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius parvus</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
<i>Tyrannochthonius pecki</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius pholeter</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius pluto</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
<i>Tyrannochthonius sata</i>	a cave obligate pseudoscorpion	--	G1	SNR
<i>Tyrannochthonius sheltae</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius skeletonis</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius stygius</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius tartarus</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius tenuis</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Tyrannochthonius torodei</i>	a cave obligate pseudoscorpion	--	G1	S1
Family Neobisiidae		--		
<i>Alabamocreagris mortis</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
<i>Alabamocreagris pecki</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2
<i>Microcreagris eurydice</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Microcreagris nickajackensis</i>	a cave obligate pseudoscorpion	--	G1G2	S1S2

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<i>Microcreagris persephone</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Microcreagris pluto</i>	a cave obligate pseudoscorpion	--	G1	S1
<i>Microcreagris subatlantica</i>	a cave obligate pseudoscorpion	--	G1G4	SNR
PHYLUM MANDIBULATA				
Class Diplopoda				
ORDER CHORDEUMATIDA				
Family Cleidogonidae				
<i>Pseudotremia minos</i>	a cave obligate millipede	--	G1G2	SNR
<i>Pseudotremia nyx</i>	a cave obligate millipede	--	G1G2	SNR
<i>Pseudotremia rhadamanthus</i>	a cave obligate millipede	--	G1G2	SNR
ORDER JULIDA				
Family Zosteractinidae				
<i>Ameractis satis</i>	a cave obligate millipede	--	G1G4	SNR
Class Insecta				
ORDER COLEOPTERA				
Family Carabidae				
<i>Pseudanopthalmus alabamae</i>	a ground beetle	--	G1G3	SNR
<i>Pseudanopthalmus assimilis</i>	West Wills Valley Cave Beetle	--	G1G2	S1
<i>Pseudanopthalmus distinguens</i>	a ground beetle	--	G1G2	S1
<i>Pseudanopthalmus fulleri</i>	a cave obligate ground beetle	--	G1G3	S2
<i>Pseudanopthalmus humeralis</i>	a ground beetle	--	G1G2	S1S2
<i>Pseudanopthalmus lodingi</i>	a ground beetle	--	G1G2	S2
<i>Pseudanopthalmus nickajackensis</i>	Nickajack Cave Beetle	--	G1G3	S1
<i>Pseudanopthalmus profundus</i>	a cave obligate beetle	--	G1G3	S2
<i>Pseudanopthalmus sequoyah</i>	Sequoyah Cave Beetle	--	G1	SNR
Family Cicindelidae				
<i>Cicindela marginipennis</i>	Cobblestone tiger beetle	--	G1G3	S2S3
Family Dytiscidae				

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<i>Hydroporus folkertsii</i>	Folkerts' Hydroporus Diving Beetle	--	G1G3	S1S2
Family Elmidae				
<i>Stenelmis gammoni</i>	Gammon's Stenelmis Riffle Beetle	--	G1G3	S1S2
Family Eubriidae				
<i>Dicranopselaphus variegatus</i>	Variegated False Water Penny Beetle	--	G1G3	S1S3
Family Gyrinidae				
<i>Spanglerogyrus albiventris</i>	Primitive Whirligig Beetle	--	G1G3	S1S2
Family Leiodidae				
<i>Ptomaphagus episcopus</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus hazelae</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus julius</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus laticornis</i>	a beetle	--	G1G2	S1
<i>Ptomaphagus lodingi</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus solanum</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus torodei</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus walteri</i>	a cave obligate beetle	--	G1G2	SNR
<i>Ptomaphagus whiteselli</i>	a cave obligate beetle	--	G1G3	SNR
Family Pselaphidae				
<i>Batriasymmodes troglodytes</i>	a beetle	--	G1G2	S1
<i>Batrisodes cavernosus</i>	a beetle	--	G1	S1
<i>Batrisodes jocuvestus</i>	a beetle	--	G1	S1
<i>Batrisodes jonesi</i>	a beetle	--	G1G3	S1
<i>Batrisodes profundus</i>	a beetle	--	G1	S1
<i>Batrisodes subterraneus</i>	a beetle	--	G1	S1
<i>Batrisodes tumoris</i>	a beetle	--	G1	S1
<i>Batrisodes valentinei</i>	a beetle	--	G1G4	S2
<i>Speleobama vana</i> a beetle	a beetle	--	G1	S1
<i>Speleochus croceus</i>	a cave obligate beetle	--	G1G2	SNR

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<i>Speleochus stygicus</i>	a cave obligate beetle	--	G1G2	SNR
<i>Speleochus synstygicus</i>	a cave obligate beetle	--	G1	SNR
<i>Subterrochus eurous</i>	a cave obligate beetle	--	G1G3	SNR
<i>Subterrochus ferus</i>	a cave obligate beetle	--	G1G3	SNR
<i>Tychobythinus jonesi</i>	a cave obligate beetle	--	G1G2	SNR
Family Silphidae				
<i>Nicrophorus americanus</i>	American Burying Beetle	LE	G1	SH SP
ORDER COLLEMBOLA				
Family Entomobryidae				
<i>Pseudosinella nata</i>	a cave obligate springtail	--	G1	SNR
Family Hypogastruridae				
<i>Schaefferia alabamensis</i>			G1G2	SNR
<i>Schaefferia christianseni</i>	a cave obligate springtail	--	G1	SNR
Family Onychiuridae				
<i>Onychiurus janus</i>	a cave obligate springtail	--	G1G3	SNR
<i>Onychiurus paro</i>	a cave obligate springtail	--	G1	SNR
ORDER DIPLURA				
Family Campodeidae				
<i>Litocampa henroti</i>	a hexapod	--	G1G2	S1
<i>Litocampa</i> sp 1	a cave dipluran (Salamander Cave)	--	G1	S1
ORDER EMPHEMEROPTERA				
Family Baetiscidae				
<i>Baetisca becki</i>	a mayfly	--	G1G3	S1
Family Behningiidae				
<i>Dolania americana</i>	American Sand Burrowing Mayfly	--	G1	S1
Family Isonychiidae				
<i>Isonychia bernerii</i>	a mayfly	--	G1G3	SNR
Family Oligoneuridae				

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<i>Homoeoneuria cahabensis</i>	Cahaba Sand-Filtering Mayfly	--	G1G3	S1S2
ORDER LEPIDOPTERA				
Family Hesperidae				
<i>Hesperia meskei</i>	Meske's Skipper	--	G1G4	S3?
Family Nymphalidae				
<i>Neonympha mitchellii</i>	Mitchell's Satyr	LE	G1G2	S1S2
ORDER ODONATA				
Family Cordulidae				
<i>Neurocordulia clara</i>	Apalachicola Shadowfly	--	G1G3Q	S1S2
<i>Somatochlora hineana</i>	Hine's Emerald	LE	G1G3	SH
Family Gomphidae				
<i>Gomphus consanguis</i>	Cherokee Clubtail	--	G1G3	S1S2
<i>Gomphus septima</i>	Septima's Clubtail	--	G1	S1S2
ORDER PLECOPTERA				
Family Perlidae				
<i>Beloneuria jamesae</i>	Cheaha Beloneurian Stonefly	--	G1	S1S2
PHYLUM CRUSTACEA				
Class Malacostraca				
ORDER AMPHIPODA				
Family Crangonyctidae				
<i>Batrachus wilsoni</i>	an amphipod	--	G1G1	S1
<i>Stygobromus inexpectatus</i>	a cave obligate amphipod	--	G1	S1S2
<i>Stygobromus smithi</i>	Alabama Well Amphipod	--	G1G3	S1
ORDER DECAPODA				
Family Atyidae				
<i>Palaemonias alabamiae</i>	Alabama Cave Shrimp	LE	G1G3	S1
<i>Palaemonias sp.</i>	Tuscumbia Cave Shrimp	--	G1	S1
ORDER PODOCOPIDA				

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## Family Entocytheridae

<i>Dactylothere arcuata</i>	a cave obligate shrimp	--	G1G1	SNR
<i>Dactylothere steevesi</i>	a cave obligate shrimp	--	G4	SNR

## ORDER ISOPODA

## Family Trichoniscidae

<i>Miktoniscus alabamensis</i>	Small Alabama Sowbug	--	G1	SNR
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## Appendix 2-1. Outstanding Alabama Waterway Designations

Water body	From	To
Weeks Bay	Bon Secour Bay	Fish River
Little River and tributaries	Coosa River (Weiss Lake)	Junction of East Fork of Little River and West Fork of Little River
East Fork of Little River and Tributaries	Little River	Alabama-Georgia state line
West Fork of Little River and Tributaries	Little River	Alabama-Georgia state line
Sipsey Fork and Tributaries	Sandy Creek	Its source
Cahaba River	Alabama River	Junction of lower Little Cahaba River
Cahaba River	Junction of lower Little Cahaba River	Shelby County Road 52
Cahaba River	Dam near U.S. Hwy 280	Grants Mill Road
Cahaba River	U.S. Hwy 11	Its source
Little Cahaba River (Bibb County)	Cahaba River	Its source (jct. of Mahan and Shoal creeks)
Tensaw River	Junction of Tensaw and Apalachee rivers	Junction of Briar Lake
Tensaw River	Junction of Briar Lake	Junction of Tensaw Lake
Briar Lake	Junction of Tensaw River	Junction of Tensaw Lake
Tensaw Lake	Junction of Tensaw River	Bryant Landing
Hatchet Creek	Lake Mitchell	Norfolk Southern Railway
Hatchet Creek	Norfolk Southern Railway	Junction of East Fork Hatchet Creek and West Fork hatchet Creek
East Fork Hatchet Creek	Hatchet Creek	Its source
West Fork Hatchet Creek	Hatchet Creek	Its source

*Source: ADEM, 2004*



## Appendix 5-1.

### Existing Plans and Programs for Monitoring GCN Species and/or their Habitats

Monitoring Program or Action	Implementation Lead	Level of Monitoring		
		Species	Guild	Habitat
Acmar/Moody Environmental Justice Society (monitor water quality in St. Clair Co.)	Acmar/Moody Environmental Justice Society			X
Alabama - Mississippi Rapid Assessment Team (survey for potential aquatic invasives)	MBNEP	X	X	
Alabama Black Bear Alliance	AWF, TNC	X		
Alabama Coastal Cleanup	ADCNR			X
Alabama CoastWatch (monitor water quality)	Alabama Coastal Foundation			X
Alabama Endangered Bats Cave Survey: Recovery Plan, Priority, and Other Caves	ADCNR Non-game Wildlife Program	X	X	
Alabama Forest Legacy Program; Assessment of Need	Alabama Forest Resources Center			X
Alabama Inventory List: the Rare, Threatened and Endangered Plants, Animals, and Natural Communities of Alabama	NS-ALNHP	X	X	
Alabama's 2004 Integrated Water Quality Monitoring and Assessment Report	ADEM			X
Alabama-Tombigbee River Basins Management Plan	ADEM			X
Atlas of Cerulean Warbler Populations	USFWS	X	X	
Bird Breeding Atlas Project	AOS	X	X	
Black Warrior River Basin Management Plan	ADEM			X
Cahaba River Basin Management Plan	Cahaba River Basin Clean Water Partnership			X
Chattahoochee-Chipola River Basin Management Plan	ADEM			X

## Appendices

Monitoring Program or Action	Implementation Lead	Level of Monitoring		
		Species	Guild	Habitat
Choctawhatchee-Pea-Yellow River Basins Management Plan	ADEM			X
Clean Marina Programs	Mississippi-Alabama Sea Grant Consortium			X
Conecuh-Sepulga-Blackwater Rivers Basin Management Plan 2004 draft	ADEM			X
Derelict Crab Trap Recovery Program	ADCNR			X
Ducks Unlimited's Conservation Plan: Meeting the Annual Life Cycle needs of North America's Waterfowl	Ducks Unlimited	X	X	
Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems	NatureServe			X
Expanding the Vision: 1998 Update, North American Waterfowl Management Plan	USFWS	X	X	
Fowl River Water Quality Monitoring	Alabama Coastal Foundation			X
Mid-Coosa River Basin Management Plan 2003	ACWP			X
Middle Coosa River, Upper Coosa River, Eightmile Creek, and Cotaco Creek Nonpoint Source Prioritization Project	NS-ALNHP			X
Mobile Bay Freshwater Mussel and Snail plan for controlled propagation, augmentation, and reintroduction 2003	USFWS			
North American Bat Conservation Partnership Strategic Plan 2004	North American Bat Conservation Partnership	X	X	
Partners in Flight North American Landbird Conservation Plan 2003	PIF	X	X	
Rare Bird Alert	Alabama Ornithological Society	X	X	
Recovery Plan: Alabama Beach Mouse 1987	USFWS	X		
Recovery Plan: Alabama Red-bellied Turtle 1988	USFWS	X		
Recovery Plan: American Burying Beetle 1991	USFWS	X		
Recovery Plan: Anthony's Riversnail 1997	USFWS	X		
Recovery Plan: Blue Shiner	USFWS	X		

## Appendices

Monitoring Program or Action	Implementation Lead	Level of Monitoring		
		Species	Guild	Habitat
Recovery Plan: Cahaba Shiner	USFWS	X		
Recovery Plan: Clubshell and Northern Riffleshell 1994	USFWS	X		
Recovery Plan: Cracking Pearlymussel 1990	USFWS	X		
Recovery Plan: Cumberland Elktoe, Oyster Mussel, Cumberlandian Combshell, Purple Bean, and Rough Rabbitsfoot 2004	USFWS	X	X	
Recovery Plan: Eastern Indigo Snake 1982	USFWS	X		
Recovery plan: Endangered Fat Threeridge, Shinyrayed Pocketbook, Gulf Moccasinshell, Ochlockonee Moccasinshell, Oval Pigtoe; Threatened Chipola Slabshell, and Purple Bankclimber 2003	USFWS	X	X	
Recovery Plan: Flattened Musk Turtle 1990	USFWS	X		
Recovery Plan: Florida Manatee 1996	USFWS	X		
Recovery Plan: Florida Panther 1987	USFWS	X		
Recovery Plan: Gopher Tortoise 1990	USFWS	X		
Recovery Plan: Gray Bat 1982	USFWS	X		
Recovery Plan: Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico 1993	NMFS and USFWS	X		
Recovery Plan: Indiana Bat (Revised) 1996	USFWS	X		
Recovery Plan: Inflated Heelsplitter 1992	USFWS	X		
Recovery Plan: Kemp's Ridley Sea Turtle 1992	USFWS and NMFS	X		
Recovery Plan: Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico 1992	NMFS and USFWS	X		
Recovery Plan: Little-wing Pearlymussel 1989	USFWS	X		
Recovery Plan: Mississippi Sandhill Crane 1991	USFWS	X		
Recovery Plan: Mobile Basin Aquatic Ecosystem 2000	USFWS			X

## Appendices

Monitoring Program or Action	Implementation Lead	Level of Monitoring		
		Species	Guild	Habitat
Recovery Plan: Palezone Shiner	USFWS	X		
Recovery Plan: Piping Plover, Atlantic Coast Population (Revised) 1996	USFWS	X		
Recovery Plan: Red Hills Salamander 1983	USFWS	X		
Recovery Plan: Red Wolf 1990	USFWS	X		
Recovery Plan: Red-cockaded Woodpecker 2003	USFWS	X		
Recovery Plan: U.S. Breeding Population of the Wood Stork (Revised) 1996	USFWS	X		
Recovery Plan: U.S. Population of Atlantic Green Turtle 1991	NMFS and USFWS	X		
Recovery Plan: U.S. Population of Loggerhead Turtle 1991	NMFS and USFWS	X		
Recovery Plan: Watercress Darter	USFWS	X		
Recovery/Management plan: Gulf Sturgeon 1995	USFWS and NMFS	X		
Review of the Progress on the North American Bird Conservation Initiative	North American Commission for Environmental Cooperation	X	X	
Revised Land and Resource Management Plan; National Forests in Alabama 2004	USFS			X
Tallapoosa Basin Management Plan	ADEM			X
Tennessee River Basin Management Plan	ACWP 2003			X
Waterbird Conservation for the Americas: The North America Waterbird Conservation Plan 2002	PIF	X	X	
Wolf Bay Watershed Project (develop management plan)	Alabama Coastal Foundation			X

## Appendices

## Appendix 6-1. Public Input Plan per Citizen Participation by Objective (CPO)

This appendix outlines the public input plan designed to communicate information on the CWCS to its stakeholders and public. It was developed using the Bleiker CPO program which identified the most effective outreach techniques for this effort. Those techniques included: Open Meetings and Forums, Content-type Advice-Giving Advisory Committees, Existing Clubs, Groups Organizations and their newsletters, School Systems and Institutions, and Electronic Bulletin Boards and websites. Results from the CPO were used to develop the following Public Input Plan for Alabama for this CWCS effort. The following table represents Alabama's Input Plan used to target outreach PAI tiers, methods, and timing of each method.

Outreach Method employed  Type of Promotion	Audiences Targeted			Target Date 1/2004- 1/2015	Estimated number of people reached
	Tier 1- Taxa Committees, Stakeholders- Collaborators Goal: Consult and collaborate	Tier 2 Stakeholders- Interested but limited investment Goal: Inform and involve	Tier 3- General Public Goal- Inform		
Direct Mail/email Fact sheets - BAMA Environmental newsletter	Email, mail	Email, mail		Quarterly- minimum biannually	100+ orgs
Follow-up Informal Meeting	X	X		Quarterly- "	250 people
Direct mail/email Brochures/Flyers	Email, mail	Email, mail		Quarterly- "	100+ orgs
Website- Updated quarterly <b>Development</b> Phase 1- Introductory material Phase 2- GCN species/habitat info Phase 3- Conservation Actions, Threats Phase 4- Conservation Actions Draft Phase 5- Draft Plan review update Phase 6- final plan announcement <b>Implementation:</b> Annual SWG updates, proposal solicitation and status review.				Updated quarterly <b>April-</b> Intro materials <b>July-</b> GCN info, solicit <b>October</b> Conservation actions - solicit input <b>Jan 05-</b> C Actions draft <b>March 05</b> Draft plan <b>September 05-</b> Final Annual updates (1-2/year) 2005-2015	General Public

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Steering Committee- DCNR/agency internal memo, meetings thru CWCS development Quarterly thru 2006 then 2/yr through 2015				Monthly updates	20
Expert Advisory Committees/ Taxa Chairs 2011-2115 – Symposium planning and proceedings for next CWCS	Meet for annual status review and updates Planning for symposium and workshops	Review status updates, symposium planning		Min- quarterly, consult as needed	50 committee members Core group 10
Existing Stakeholder Mechanisms Newsletters- put in org newsletters	X	X		Quarterly- 2004-5 Biannually 2006-11 Quarterly 2011-2015	100+ groups
Newspaper Articles/features				Minimum annually	General public
Magazine articles- state conservation orgs	Include updates in newsletter	Include updates in newsletters	Include updates in Press releases and magazine.	"	5 major orgs
Public relations: agency press releases	As appropriate			with website updates	General public
Workshop (Symposium- every 10 years)	June- GCN Conservation Actions			2 for Tier 1, possible invite to Tier 2	
Exhibit at Meetings				All Possible meetings- set up exhibit	50+ orgs stakeholder
DCNR staff present at all meetings possible	Distribute brochures, and updates	Distribute brochures, and updates	Distribute brochures, and updates	All meetings possible	stakeholder
Presentations to Tier 2 and 3 groups				As requested	stakeholder

## Appendices

## Appendix 6-2.

### Coordination with Partners and Stakeholders: Meetings and Contacts

Organization Represented	Contacts and Attendees
ADCNR State Lands Division Natural Heritage Section Staff	Greg Lien and all staff
ADCNR Wildlife & Freshwater Fisheries Section Staff	Gary Moody, Chief and all section staff
Alabama Department of Environmental Management	James McIndoe and many program staff
Alabama Department of Transportation	John Shill
Alabama Forestry Association	Members representing University, Partner Agency and NGO, Key Stakeholders
Alabama Forestry Commission	Bruce Springer and staff
Alabama GAP	Amy Silvano, Barry Grand, Elise Irwin and staff
Alabama Land Trust	Mark Pentecost and staff
Alabama Natural Heritage Program	Bob Hastings and staff
Alabama Power Company	Malcolm Pierson
Alabama Wildlife Federation	Tim Gothard and staff
Coastal Agencies	David Yeager and Staff
Coosa Basin CWP Steering Committee	Annette Spivey
CWCS Coordinating Committee	WDC, Contractor staff (3)
CWCS Scientific Advisory Committee	External experts (University, Partner Agency and NGO, key Stakeholders)
CWCS Steering Committee	J. McHugh (WDC), Section Chiefs and Asst. Chiefs, Wildlife and Freshwater Fisheries Division Non-game staff, accountant, , contractor
CWCS Technical Committee	Wildlife Section Asst. Chief and Non-game program coordinator, Fisheries Section Asst. Chief and Non-game program coordinator, WDC, contractors, SLD-NHS database manager
Freshwater Mussel Cons. Soc.	Annual meeting- presentation to all participants
Geological Survey of Alabama	Pat O'Neil and staff
IAFWA TWW/SWG staff	Chadwick/Edelson
Longleaf Alliance	Rhett Johnson and staff
Marine Resources Division	Steve Heath and staff
Mobile River Basin Coalition	Larry Goldman and staff
Mussel Experts	Jeff Garner
Nongame Conference Coordination and Proceedings Editor and Auburn University Dept of Forestry and Wildlife	Ralph Mirarchi, Auburn University Faculty and Staff
PARC	J. Holmes, L. Powers
Poarch Creek Indians	Robert Thrower
R4 USFWS staff	Jimenez
State Parks - Natural Resources	Carl Scardina and staff
Taxa Committee Chairmen	5 taxa committee chairpersons- bird, mammals, herps, fish, Inverts
TNC - Alabama Field Office	Jeff Danter and all staff
US Dept. of Defense-Corps of Engineers	Brian Peck

Appendices

USDA - Forest Service

USDA - NRCS

USFWS, Endangered Species , private lands

USFWS, NWR and TVA staff

Steve Rickerson and all technical wildlife and planning staff

Tim Albritton and program staff

Larry Goldman and staff

Dwight Cooley and NWR staff, TVA staff